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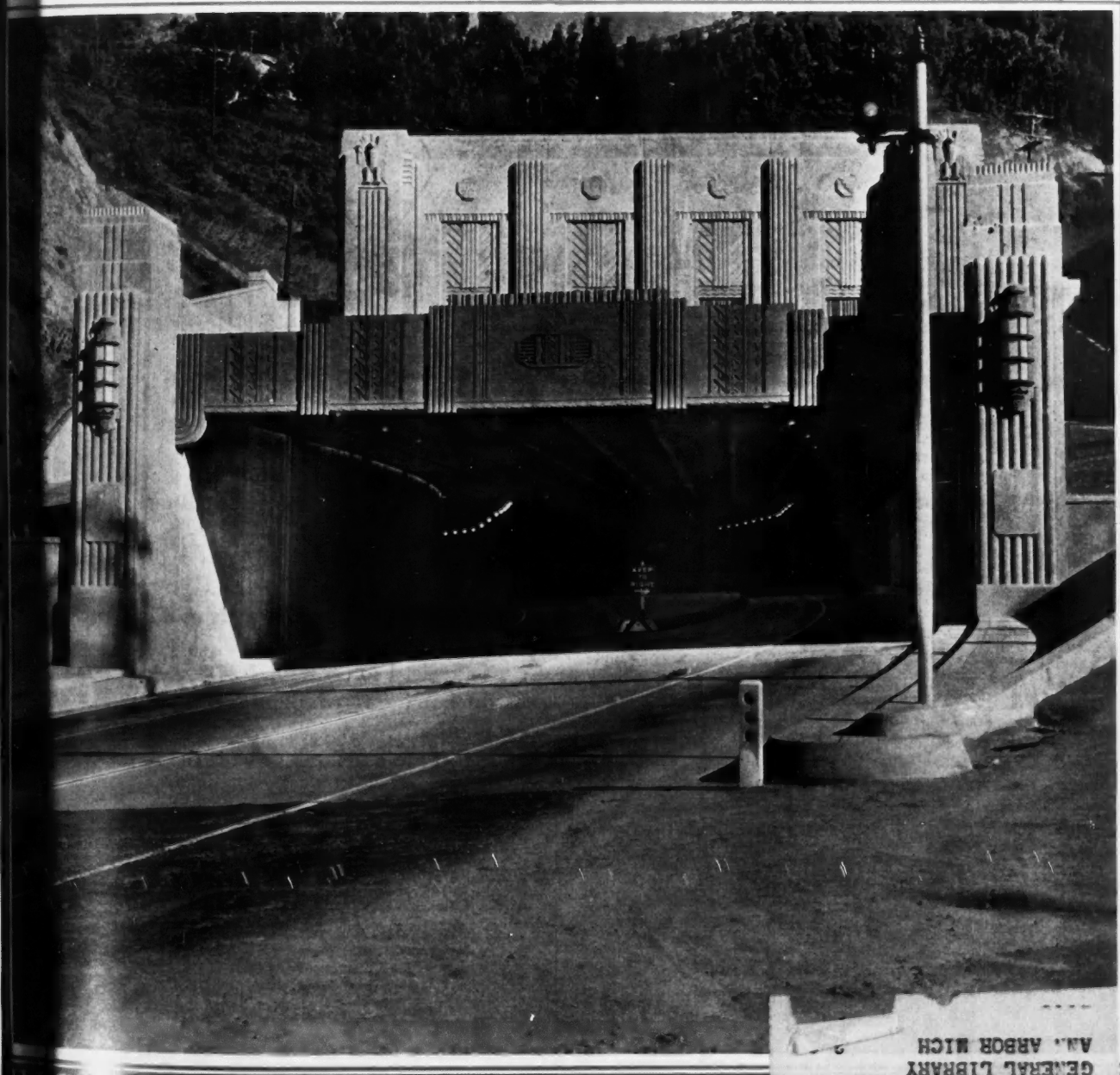

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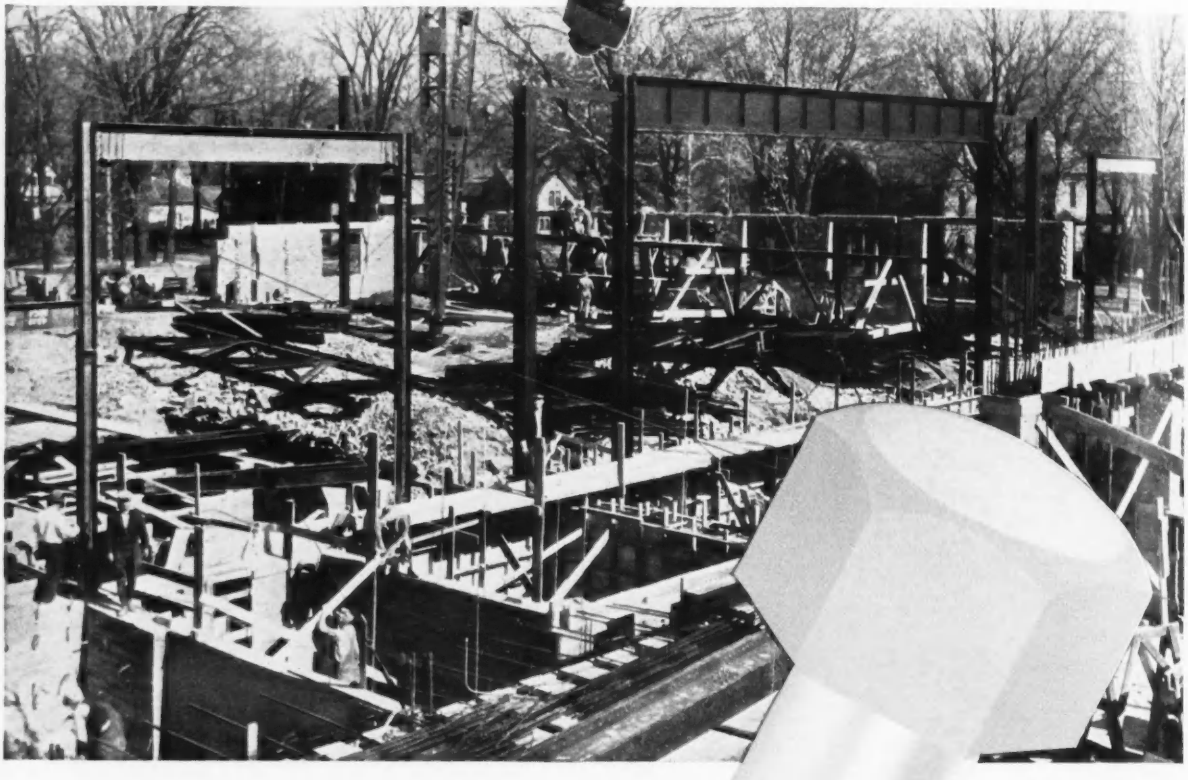

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Vol. 120 *FEBRUARY 17, 1938* No. 7

THIS WEEK AND NEXT

MOTORISTS who travel from Contra Costa County to Oakland, Calif., through the Broadway vehicle tunnel will not suffer temporary blindness caused by quick change from daylight to artificial light. Canopies over the approaches provide a zone of light gradation by the use of varying-opening louvers.

U. S. Engineers at Rock Island, Ill., have made many studies of concrete mixing and placing methods in connection with the construction of Mississippi Locks and Dams Nos. 10 to 22. John L. Rohwedder discusses these tests on page 262.

Continuing his series on Midwestern waterworks, W. W. DeBerard, of the News-Record *staff, tells how the Des Moines waterworks has operated profitably for 18 years.*

Designing reinforced concrete columns in accordance with the new A.C.I. building regulations is covered in a procedure offered by James R. Bole, Long Beach, Calif., engineer.

Cotton's place in roadbuilding is being established as it is used experimentally in curing concrete and strengthening thin bituminous mats. During the last two years some 35 states have used the material.

The dark cloud of the Elysian Park slide in Los Angeles had its silver lining for the engineers in that it afforded them an opportunity to observe how a reinforced concrete viaduct fails under stresses much greater than those for which it was designed. In addition to the effects of great moving earth loads, engineers could observe the effects of impact loads resulting when massive boulders struck the roadway.

NEXT WEEK—Less than two years ago Mississippi inaugurated its first state-wide highway building program. What has been accomplished is recorded in next week's issue.

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THE COVER PICTURE is of the "light transition" approach to the Broadway vehicular tunnel between Oakland, Calif., and Contra Costa County, described on page 259.

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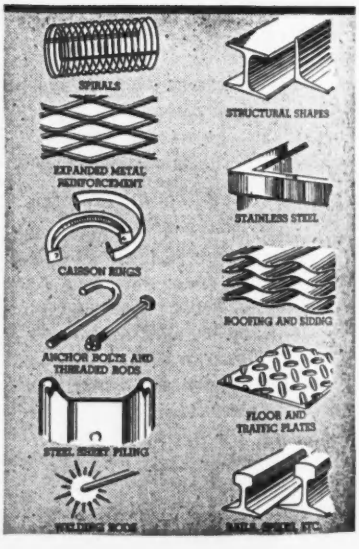


RYERSON STEEL-SERVICE

THE WEEK'S EVENTS

Power Cost Allocated At Bonneville Dam

Charge to power is 22 per cent of initial cost and 57 per cent of ultimate investment

The Federal Power Commission announced Feb. 10 that it has allocated $11,682,400 as the portion of the cost of the initial power development at Bonneville Dam which is chargeable to power. This is 22 per cent of the $53,188,000 cost of the project with present power installation. Ultimately, as additional generating machinery is added up to the full capacity of the development, the commission will increase the charge for power to a final value of $42,181,000, or 57 per cent of the ultimate capital investment estimated at $74,144,000.

On the same day Secretary Ickes announced that he had approved and sent to the War Department a request from Bonneville Administrator J. D. Ross for installation of two additional generating units.

The ruling of the Federal Power Commission is made in accord with a provision of the Bonneville Power Act, approved last August, which directs the commission to allocate to power a proportion of the cost of the development including "such a share of the cost of facilities having joint value for the production of electric energy and other purposes as the power development may fairly bear." Rate schedules are to be based upon this allocation, with the intention of returning to the federal government "over a reasonable period of years" its investment chargeable to power.

Costs were divided as follows:

	Initial Cost	Ultimate Cost
Navigation facilities	$5,517,600	$5,517,600
Power facilities....	9,180,500	29,448,000
Joint facilities.....	38,490,700	39,179,000
TOTAL	53,188,800	74,144,600

Cost estimates cover the initial 86,400-kw. development on which commercial service will begin within a few months, and the ultimate installation of of about 504,000 kw. These costs include interest during construction of 1.54271 per cent, the "weighted average rate" paid on all money borrowed by the United States from Nov. 1, 1933 to Dec. 31, 1937.

In determining the proportion of cost chargeable to power the commission determined that at full development 32.5 per cent of the jointly used facilities might fairly be allocated to power, giving a charge of $12,133,000. To this was added the cost of power facilities, amounting to $29,448,000, giving a total power allocation for the final project of $42,181,000. No explanation is given as to the basis for the figure of 32.5 per cent.

Initial development

The same general procedure was followed to determine the allocation for the initial development. The 32.5 per cent figure was applied to the $38,490,700 cost of jointly used facilities, and this result was divided by 5 because the power plant is initially installed only to one-fifth of its ultimate capacity. To the resulting figure of $2,509,100 is added the cost of facilities devoted exclusively to power, $9,180,500, to yield a total of $11,682,400 chargeable to power production in the initial development.

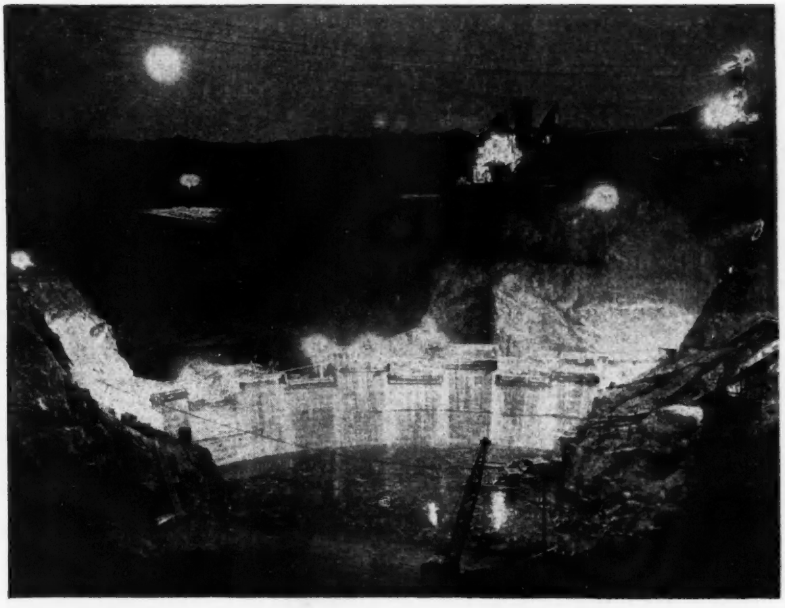
Disagree with Markham

The division of costs as between power, navigation and joint facilities made by the commission is not greatly different from that proposed by Major General Markham, former Chief of Engineers, in testimony before the House committee on rivers and harbors during its consideration of the Bonneville bill.

This testimony was presented March 9, 1937, when considerable work still remained to be done on the project. General Markham estimated the cost of navigation facilities at $5,631,300; of power facilities at $11,089,400 initially and $31,556,000 ultimately; of jointly used facilities at $38,046,600.

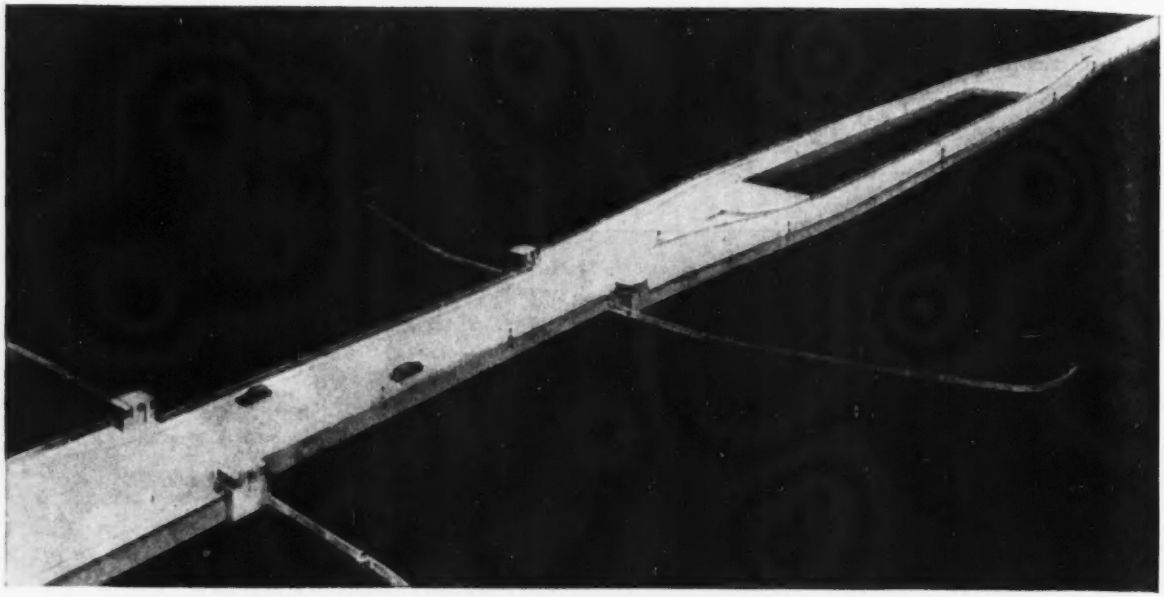
General Markham, however, proposed that half the cost of joint facilities be charged to power, and on this

(*continued on page 248*)



PARKER CONCRETE WORK NEARS COMPLETION

PARKER DAM on the Colorado River is now within 3 ft. of its ultimate height of 340 ft., two-thirds of which is below river level. This picture, taken some months ago, shows night operations by which this vast construction record was made. The dam forms a pool from which water is pumped into the Colorado Aqueduct of the Metropolitan Water District.



SLIDING SPAN FOR PROPOSED PONTOON BRIDGE

AN ARTIST'S DRAWING shows the movable span which is planned for the proposed pontoon bridge across Lake Washington at Seattle. The floating span would be opened by drawing it back into the slot of open water. It is believed the operation could be accomplished in about 1.5 min.

It is proposed that the pontoon bridge carry a four lane roadway and two sidewalks. Plans announced by state highway director Murrow call for a 5,671 ft. pontoon structure made up of cells 309 ft. long and 60 ft. wide joined together in rigid units 1,237 ft. long. The pontoons would be anchored to the bottom by four or six cables attached to blocks of concrete.

Approaches to the pontoon bridge would be fixed structures providing a vertical clearance of 30 ft. to permit passage of small boats.

The relative economy of a pontoon bridge at this site arises from the fact that the water is 150 to 180 ft. deep and that soft mud on the bottom extends down almost an equal distance. The bridge is made feasible by the fact that the level of the lake is controlled by canal locks.

Power Cost Set At Bonneville

(*Continued from page 247*)

basis he calculated the capital cost chargeable to power at $30,112,400 for the initial development and $50,579,000 for the full ten-unit installation. On this capital cost, and including allowances for annual operating costs, he estimated that the unit cost of power produced by the full development would be 0.859 mills per kilowatt-hour, with a cost for firm energy of 1.737 mills and for saleable seasonal energy of 1.286 mills. Figuring interest at 4 per cent, he estimated that the average revenue from saleable energy should be 1.53 mills to permit the project to pay. These figures, of course, were based upon certain assumptions as to stream flow, local factors and other conditions on which definite figures were not obtainable.

Administrator Ross' request for two new units, which will double the developed capacity of Bonneville, is made in accordance with the provision of the Bonneville act which provides that the Secretary of War install additional generation facilities when the administrator judges that these are desirable. Mr. Ross finds that a market exists for more than 250,000 kw., three times the output of the present installation and more than half of the ultimate production of the Bonneville plant. Since it will require at least two years to design, build and install the additional units, he believes that it is none too early to submit his request.

That Administrator Ross' request will be granted is indicated by the fact that the budget bureau has already approved supplemental estimates providing $2,800,000 to be expended by the War Department during the coming fiscal year for additional generators with a total cost of $5,825,500, and $2,050,000 for the Interior Department, to cover additional expenditures during the same period for transmission lines in the Bonneville area. The latter supplements an item of $1,450,000 in the original budget earmarked for expenses of the Bonneville Authority, including transmission lines. Congress will act on these recommendations in the near future, when considering the regular appropriation bills for the two departments.

It is understood that Mr. Ross intends, if sufficient funds are provided, to build a double-circuit line west to Vancouver, with branches from this point south to Portland and north to communities along the lower Columbia, as well as a short line to serve industries located in the vicinity of Bonneville.

. . .

A.I.S.C. Selects Award Jury For Student Designs

A jury of engineers and architects has been appointed to select the prize winning design for an elevated highway submitted in the student bridge design competition which is held each year by the American Institute of Steel Construction.

The jury will consist of Frank M. Masters, Harrisburg consulting engineer; E. H. Praeger, chief engineer of Madigan-Hyland of New York City; Aymar Embury II, and Randolph Evans, New York City architects, and Howard Myers, editor of *The Architectural Forum.*

The jury will meet April 19 to make selections from designs submitted. Competitors must submit their designs before April 9.

THE CURRENT TREND

This week's news of contract volume and construction cost factors

Construction Up 28 Per Cent

Both public and private awards gain. Construction cost index lower for second successive month

Engineering construction awards for the first six weeks of 1938, $315,825,000, are 28 per cent above the $247,538,000 reported by *Engineering News-Record* for the corresponding period last year. Of the 1938 total, $131,601,000 is private, 35 per cent above 1937; and $184,224,000 is public, 22½ per cent above last year.

The public construction total is made up of federal awards, $53,693,000, and state and municipal awards, $130,531,000, which are 194 per cent higher and 1 per cent lower, respectively, than a year ago. The federal gain is due to the high dam contract at Grand Coulee, Washington, for $34,442,000.

Private volume up

The private construction increase over 1937 is due to the large volume of commercial building, including large scale housing. Thirty-eight large residential and apartment building projects are responsible for over $42,000,000 of the $89,100,000 total for commercial buildings in the first six weeks of this year. Of this total $50,000,000 is in New York State, including $45,000,000 in New York City; and $11,000,000 is in New Jersey. The high New York City volume is in large measure due to a rush to file plans under the old building code. Some of this work where "owner builds" may lag in actually getting under way. A total of $84,000,000 in building permits was filed in New York City during January to get the benefit of the old city building code. Industrial buildings account for $34,400,000 of the private total so far in 1938, a decline from the high values of last year.

Public awards gain

Public awards are above last year, due to larger volume in streets and roads, public buildings, and earthwork and drainage. Nineteen large highway lettings in 13 states totalling over $15,000,000 are responsible for the highway gain; PWA financed building programs in various states, and the Pennsylvania institutional building program caused the public building gain. The $34,442,000 federal government contract for the completion of the high dam at Grand Coulee increased the earthwork and drainage total to almost four times that of a year ago.

Territorial distribution of construction awards for January, 1938, compared with a year ago shows increases of 20 per cent in Middle Atlantic; 17 per cent in Far West; 13 per cent in West of Mississippi; 1 per cent in the South; and decreases of 6 per cent in Middle West; and 8 per cent in New England.

Costs turn down

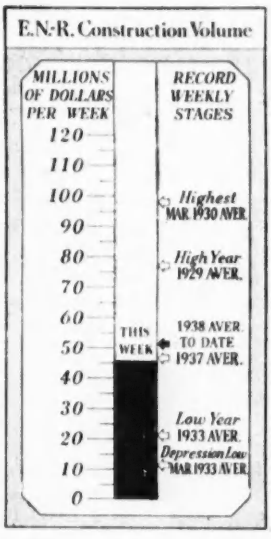
The *ENR* construction cost index for February is 243.39, a drop of 0.46 of a point, or 0.2 per cent below January. This is the second successive month that a drop has occurred. The lower January index is due to a fall in the lumber price; while the lower February index is due to a decrease in the 20-cities common labor average rate. This decrease in labor is partially offset by an increase in the cement price. Although January and February are 0.5 and 0.8 per cent below December, they are 9.0 and 8.8 per cent, respectively, above their corresponding months last year.

New capital

New capital for construction purposes for the six weeks of 1938 totals $105,647,000, a decrease of 7½ per cent from that reported in 1937 at this time. United States Steel Corporation's borrowing of $50,000,000 for improvements and expansion during the last week offset the Pennsylvania Railroad's $50,000,000 loan in the early weeks of last year, so that now corporate borrowings exceed those of a year ago by 11 per cent. State and municipal borrowings total $41,175,000, a drop of 35 per cent compared with 1937.

Building Permits

Building permits in January, at $146,849,695, show a gain of 23.7 per cent over December, 1937, and an increase of 114.2 per cent over January, 1937. This is the highestly monthly volume reported since April, 1931, and is due to the rush of builders in New York City to file plans before the new building code was scheduled to go into effect.



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Feb. 18 1937	Feb. 10 1938	Feb. 17 1938
Federal	$6,842	$5,600	$2,073
State & Municipal	17,856	18,675	21,851
Total public	$24,698	$24,275	$23,924
Total private	17,860	30,556	21,077
TOTALS	$42,558	$54,831	$45,001
Cumulative 1938 (7 weeks)			$360,826
1937 (7 weeks)			$290,096

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1937 7 Wk.	1938 7 Wk.
NON-FEDERAL	$167,295	$126,389
State & mun. bonds	115,983†	61,909
Corporate securities	55,003	61,230
PWA loans, grants	—3,691†	1,141
RFC loans		2,109
FEDERAL		
TOTAL CAPITAL	$167,295	$126,389

† Represents transfer from federal to private investment financing through sale by RFC of PWA bonds.

ENR INDEX NUMBERS

Index Base	1913	1926
Construction Cost (Feb.)	243.39	117.00
Construction Volume (Jan.)	167	73

New York City's January permit volume, $106,072,040, is an increase of 41.8 per cent above December, and almost nine times larger than the total for January, 1937.

January permit values for the 214 other Dun and Bradstreet cities total $40,777,655, a 7.1 per cent drop from the preceding month, and 27.1 per cent below the 1937 month.

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INDEX OF SHIPMENTS of construction materials for December, 41, is a drop of 20 points, or 33 per cent from the 61 reported in November by the PWA Projects Division. Base, 1929=100.

Water Tunnel Work To Be Readvertised

Board of Water Supply of New York City to ask new bids on Delaware aqueduct work

New bids on three contracts for work on the Delaware System aqueduct are to be called by the Board of Water Supply of New York City. This decision was reached on Feb. 9 following a long controversy over the high rates of pay set for the work by the state labor department. The date for the new call for bids has not been set.

Bids on the proposed work were opened in November (*ENR* Nov. 11, p. 771) and the low bidders on the three contracts totaling 101,000 ft. of tunnel with shafts were George H. Flinn Corp., New York; a combination of Siems-Helmers, Johnson, Drake & Piper, and Leo Butler & Bros.; and S. A. Healy Co., Chicago. The bids totaled about $34,000,000. Soon after receipt of the bids the board authorized the award of contracts to these bidders, but before the papers could be signed so much public criticism developed with respect to the high wage rates required to be paid on the work covered by these contracts that the board withheld approval.

Rates set by state

The rates specified by the board in its call for bids were those supplied to it by the comptroller of the city, as required by law. The comptroller, in turn, had received the rates from the state Department of Labor, the work being outside the city limits. The rates so specified as prevailing in Westchester and Putnam counties were far above actual rates being paid on other contracts for the aqueduct and even above those being paid on subway work within the limits of New York City.

Following the public protest over increasing the cost of the aqueduct greatly by the payment of such high rates the comptroller made a survey of actual rates paid in the counties in question and prepared a new list of prevailing rates. These are to be used by the Board of Water Supply in its new call for bids.

The principal labor items in the new set of rates are given below, as are the earlier rates.

HOURLY RATES

CLASSIFICATION	OLD	NEW
General Engineering Construction		
Skilled:		
Blacksmiths	$1.625	$1.20
Bricklayers	1.715	1.715
Carpenters	1.50	1.50
Caulkers	1.525	1.40
Cement masons	1.715	1.715
Electricians	1.65	1.65
Compressor plant operators	2.05	1.65
Compressor (multiple portable) operators	1.925	1.375
Concrete mixer operators	1.75	1.375
Concrete pump operators	1.925	1.50
Concrete power hoists	2.125	1.375
Mucking machine operators	2.125	1.70
Crane operators	2.125	1.70
Derrick operators	2.125	1.70
Hoisting engineers (elevators and cages)	1.925	1.70
Keystone dipper operators	2.125	1.70
Locomotive operators	1.925	1.50
Tunnel shovel operators	2.125	1.70
Mechanics	1.75	1.00
Metal lathers (reinf. setters)	1.75	1.75
Plumbers	1.525	1.40
Sheet metal workers	1.50	1.50
Structural ironworkers	1.925	1.65
Timbermen	1.20	1.20
Semi-skilled:		
Blacksmith helpers	1.125	.75
Chauffeurs (truck drivers)	.875	.75
Firemen or oilers	1.25	1.00
Plumber's helpers	.8125	.638
Ironworkers apprentices	1.25	1.00
Unskilled		
Laborers	.75	.75
Shafts and Tunnels in Free Air		
Blasters	1.875	1.45
Cement mason's helpers	.90	.75
Miners and drill runners	1.375	1.25
Miner and driller assistants	1.10	1.00
Laborers (shaft)	.95	.65
Laborers (tunnel)	.95	.775

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Wage Contracts Renewed As Steel Prices Fall

A cut of $4 a ton in the price of cold rolled sheets was initiated by several independent steel companies Feb. 9 and immediately met by Carnegie-Illinois Steel Corp. a few hours before the U. S. Steel Corp. signed an agreement with the Steel Workers Organizing Committee, C.I.O., extending "indefinitely" the existing wage contracts. U. S. Steel signed on behalf of four of its subsidiaries, Carnegie-Illinois, American Steel & Wire, National Tube, and Tennessee Coal, Iron & Railroad.

Contracts cancelable

The new wage agreement permits either party to the contract to cancel on 20 days notice. The contract continues in force all the provisions in the contract signed in March, 1937, including recognition of the S.W.O.C. for its members, $5 a day minimum wage, time and a half for overtime, 40-hour week, paid vacations, the seniority system, and a system of grievance committees. The union did not obtain its demand that it be recognized as exclusive bargaining agent for all employees.

The price reduction marks the first break in steel prices which had held steady at levels established last March after the general rise in steel wages. Since that time, however, steel operations have dropped from 83 per cent of capacity to a present 30 per cent; a low point of 25 per cent was reached last December.

Super-Highway Plan For City of Chicago

City engineers choose Congress St. improvement as best of fourteen proposed

Six engineers occupying important posts in the Chicago city government have recommended improvement of Congress St. as the best of fourteen possible routes for a super-highway west of the Chicago Loop. The Illinois state department of Public Works and Buildings submitted a plan two years ago for the improvement of Congress St. and essentially made an offer to cooperate in building it.

The state plan calls for a 6.6-mi. improvement from Wells St. west to Columbus Park at Central Ave. near the city limits. It would be 200 ft. wide, have eight express lanes and four service lanes, and be depressed at certain cross streets; it would cost $24,250,000. As modified by the committee of engineers, the crossings would be elevated instead of depressed so that full elevation might be carried out later.

A novel rating system for the different routes was used in preparing the report. Weights were assigned to seven factors and 36 sub-factors according to their relative importance as judged by the engineers. These factors and weights are as follows: measure of safety provided, 30 points; capacity, 18 points; location, 18 points; ease of financing, 13 points; cost per lane, 9 points; esthetic value, 9 points; adaptability of the improvement to stage construction, 3 points.

No one of the 14 plans considered rated the 100 points possible. The Congress Street development rated 74.

A second super-highway alongside the Chicago and Northwestern R.R., which rated 73 points, was recommended as a second major highway to be built to serve the north central business district. The committee states that the proposal to utilize the Lake St. four-lane elevated structure for automobiles and buses made in the traction report (*ENR*, Oct. 28, 1937, p. 694) could be substituted for this.

Cost of the first of six stages of the Congress St. project, from Wells St. to Ashland Ave., would be $8,500,000.

The engineers on the committee are as follows: Loran D. Gayton, city engineer; W. R. Matthews, assistant engineer, in charge, Department of Public Works; A. J. Schafmayer, engineer, Board of Local Improvements; Leslie J. Sorenson, engineer of traffic; J. J. Verslius, engineer of construction; Hugh E. Young, engineer, Chicago Plan Commission.

Army Officials Oppose Chicago Diversion

Testify that 1,500 sec.-ft. is sufficient for navigation purposes between Chicago and St. Louis

The proposal to continue diversion of lake waters to the Illinois River at Chicago at its present rate of 5,000 sec.-ft. after Dec. 31, when under a Supreme Court ruling it is to be reduced to 1,500 sec.-ft., was opposed by War Department engineers at hearings before the House Rivers and Harbors Committee on a bill introduced by Representative Parsons.

Major General Julian L. Schley, Chief of Engineers, told the committee that the War Department "sees no reason for changing its recommendation against the proposed diversion of more than 1,500 sec.-ft. into the Illinois waterway." Brig. Gen. Tyler, Assistant Chief of Engineers, said that 1,500 sec.-ft. diversion is "ample for a useful waterway" from Chicago down to St. Louis.

Neither officer would commit himself definitely regarding the effect on sanitary conditions of the river of retaining the present rate of flow. General Tyler said, however, that retention of the 5,000 sec.-ft. rate "might" result in better conditions. Both officers laid emphasis on construction of sewage disposal plants.

Replying to questions by Representative Parsons, General Tyler denied that had the Supreme Court named 5,000 sec.-ft. as the minimum flow the engineers would have used that figure instead of 1,500 sec.-ft. "Study of water requirements under such conditions," said the general, "should be based entirely on technical considerations such as lockage, leakage, and evaporation, as well as the factors of use."

Navigators favor bill

General T. Q. Ashburn, president of the Inland Waterways Corp., testified in support of the proposed bill, laying special emphasis on navigation problems connected with the amount of water flowing through the Illinois River. He said that "the discharge of the Illinois River water is what makes Mississippi River navigation possible throughout, since it enables us to negotiate the bottleneck" north of St. Louis. He added that reduction of the flow to 1,500 sec.-ft. will "enormously increase the difficulties of navigation we now encounter, and those difficulties will increase as Chicago and the other communities in that vicinity become greater and more industrialized." He pointed out that the increased number of groundings due to lowering of the river level constitutes "a serious factor in the cost of transportation by this river."

George Earle, New Orleans engineer, urged the committee to report the bill favorably, and argued that there should be a minimum of 10,000 sec.-ft. flowage through the Illinois River "for proper navigation and sanitation."

High Court Approves Truck Regulation

A South Carolina law limiting the width of trucks to 90 in. and their weight to 20,000 lb. was upheld by the U. S. Supreme Court Feb. 14. The court reversed a decision of the federal circuit court of appeals at Columbia, S. C., which last January granted an injunction against enforcement of the law (*ENR*, Jan. 28, 1937, p.144).

The high court held that in the absence of a federal statute regulating sizes and weights of trucks the states have full power to impose such limitations even though they affect interstate traffic. "The present case," the court stated, "affords no occasion for saying that the bare possession of power by Congress to regulate the interstate traffic forces the states to conform to standards which Congress might, but has not, adopted. . . .

"Congress . . . may determine whether the burdens imposed on [interstate commerce] by state regulation . . . are too great. . . . But that is a legislative, not a judicial function."

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Four Cars Too Many

Hoisting a muck car from tunnel level up a shaft without uncoupling it from the rest of the train won't work, for the night crew at Miller Shaft on the Loch Raven-Montebello tunnel job in Baltimore tried it last Wednesday without success. The car on the cage dragged the rest of the five-car train with it, and when the next car jammed between the tunnel roof and the cage something had to give way. It happened to be the top of the tubular steel head frame that yielded. Nobody was hurt, but the shaft will be shut down for several days until a new headframe can be built, thereby costing the J. F. Shea Co. considerable heading advance on the February progress sheet.

Labor Board Certifies Technical Union

Allis-Chalmers engineers vote for representation apart from plant workers

The National Labor Relations Board on Feb. 10 certified the Independent Engineers and Draftsmen's Association as exclusive bargaining agent for technical engineers and draftsmen at the Allis-Chalmers plant in West Allis, Wis. At the same time the United Automobile Workers of America were certified for the bulk of the production workers. The action was based upon a secret election held Jan. 3-4.

The technical engineers and draftsmen were offered the choice of being represented by the Independent Engineers and Draftsmen's Association, by the U.A.W.A., or by neither. The balloting resulted in a vote of 272 for the I.E.D.A., 13 for the U.A.W.A., 36 for neither, and two protested votes.

The I.E.D.A. is now engaged in negotiations with the Federation of Architects, Engineers, Chemists and Technicians, C.I.O., on the question of affiliation of the independent body with the C.I.O. group. It is proposed that in the event of affiliation negotiations with the Allis-Chalmers Co. for a new union contract be carried on by a joint committee of the technical group and the United Auto Workers.

The United Auto Workers has expressed itself in favor of the organization of technical workers into unions separate from the production workers. The executive board of the U.A.W.A., at a recent meeting, passed a resolution asserting that the union conforms to the C.I.O. policy which is "to encourage the organization of engineers into an organization of their own affiliated with the C.I.O." and that the U.A.W.A. would "encourage and cooperate with the F.A.E.C.T. in various plants in their efforts to organize these employees."

The auto workers' resolution was adopted in connection with negotiations now in progress aimed at affiliation with the F.A.E.C.T. of the Society of Designing Engineers, an independent union which has been active in automobile and aviation plants. A referendum of the S.D.E. membership is to be taken before April 1.

In this same connection, John L. Lewis, chairman of the C.I.O., stated in a letter to the S.D.E. that "the general position which our international unions have taken is that the specifically technical worker is different from those in an industrial classification."

General Contractors Tackle Taxes And Labor Relations

A.G.C. urges revision of undivided surplus and unemployment taxes, condemns highway curtailment and discusses labor problems at annual meeting in Washington

In serious, busy sessions at the nineteenth annual convention held in Washington Feb. 8-10, the Associated General Contractors of America took a definite stand on prevailing tax matters, thrashed out labor problems, reviewed current and proposed legislation affecting construction and listened to a great deal of advice from federal government officials. Discussion revealed that taxes have replaced labor relations as the chief worry of contractors at present. The undivided surplus tax of the 1936 Revenue Act has seriously curtailed the private construction market, the contractors contend, while the tendency of states to assess unemployment tax penalties against intermittent employers places a heavy burden on contractors, and the steady increase in taxes of all kinds paid by contractors and not by public agencies is widening the gap between contract and day labor construction costs, threatening the contract system.

The association officially ignored labor problems for a long time, but last year circumstances forced the A.G.C. to plunge into labor's troubled waters. Apparently the shock wasn't as bad as had been expected, for reports indicate the new relations between association chapters and organized labor are generally satisfactory.

Views on current problems

The annual report by Edward J. Harding, managing director, revealed the attitude and activities of the association in relation to current problems, and a series of strong resolutions passed at the meeting expressed the views of the membership in no uncertain terms. To further the cause of employment, to stimulate general business and to protect the market for construction, the association has fought the curtailment of the PWA program by executive order last Fall and the threatened reduction of federal aid for highways, and calls for a continuation of both PWA and highway work, as well as regular federal construction activities, such as river and harbor improvement.

The A.G.C. has promoted and supported plans for revising the 1936 Revenue Act to exempt funds spent by private industry for expansion, modernization and reconstruction. At the association's request Congressman Beiter (N.Y.) has introduced a bill revising the act to this extent; the bill was explained at the meeting by its author, and a resolution was passed asking for repeal of the tax.

Other tax matters discussed included the social security and unemployment taxes. The contractors point out that the high hourly wages paid in construction partly offset the intermittent employment offered by the industry. Now the contractors are being further penalized by a debit rating imposed by several states on the unemployment tax because of intermittent employment. They point out that they are unable to give continuous employment to labor because of union restrictions and public works regulations prohibiting the transfer of labor from one job to another. Wm. Hayes, counsel for the association, reported on current and proposed taxes, and painted rather a dismal picture for contracting.

Wage and hour legislation, according to a resolution sanctioned by the meeting, is not a function of the federal government, but should be left to the individual states. Other resolutions condemned gas tax diversion, called for a cessation of government competition with private business, urged full use of the contract system under the new federal Housing Act, and commended the Bureau of Contract Information for its work in promoting the welfare of construction.

Labor relations

At the San Antonio meeting a year ago it was revealed that certain chapters and branches had entered into agreements with organized labor, and sanction of such action was sought at that time. However, the old tradition of hands-off labor questions and a die-hard stand of some open-shop members outweighed the pro-labor sentiment and association approval of labor agreements was denied. During the year the general attitude toward labor relations changed, principally because more and more chapters were finding it to their advantage to deal openly with labor. At the October board meeting the chapter agreements were given official approval with certain restrictions as to local responsibility, and a labor relations department was established in the national organization to correlate the chapter activities and to serve as a clearing house for labor information.

Reports from various parts of the country reveal many types of labor agreements. Some are with certain trades only, others are with general labor organizations; some are very local and limited in extent, others are statewide. Each employer group has worked out its own labor problems, and the various reports indicate that labor relations are strictly a local problem.

There was considerable discussion of the naming of prevailing wage rates on public works, particularly in respect to a system whereby contractors would be protected against wage increases in the life of long-time contracts. Commissioner of Reclamation John C. Page pointed out that the original specifications for the high dam at Grand Coulee, for which contract has just been let, provided for an annual review of wages and an adjustment in contract prices, but that the clause was ruled out by the Comptroller General. New legislation will be required, Mr. Page declared, before such a plan can be put into effect on federal projects.

Several federal officials addressed the convention, including Thos. H. MacDonald, Chief, U. S. Bureau of Public Roads; John C. Page, Commissioner of Reclamation; Gen. J. L. Schley, Chief of Engineers; W. E. Reynolds, Assistant Director of Procurement; Congressman A. F. Beiter; Dr. E. M. Fisher, Federal Housing Administration; and Louis Johnson, Assistant Secretary of War.

Much was accomplished in each of the three divisional meetings held by the Heavy, Highway and Building Divisions of the association. Taxes and labor relations as affecting each particular field were discussed, and problems peculiar to each class of construction were given a thorough airing.

Accident prevention and apprentice training were considered in the general sessions. Wm. J. Barney supplemented the preliminary report given last October on the apprenticeship program (*ENR* Nov. 25, 1937, p. 86) with a progress report. Safety record awards were presented to winners in each field of construction. The new A.G.C. Safety Manual for Construction was reported as ready for distribution.

Edward P. Palmer, of Senior & Palmer, Inc., New York, was elected president for the coming year; Guy F. Atkinson, of San Francisco, was elected vice-president. The following were chosen chairmen of the various divisions: Heavy, J. S. Miller, Dravo Corp., Pittsburgh; Highway, M. W. Watson, Topeka, Kans.; Building, R. H. Hunt, Starrett Bros. & Eken, N. Y.

LABOR NOTES

A TOTAL of 11,179 cases have been handled by the National Labor Relations Board during the 27 months ending Jan. 1, 1938, the board announced Feb. 10.

UNION OBJECTIONS to the use of WPA workers at less than union scale to perform common labor on War Department levees and river improvement projects in the neighborhood of St. Louis has interferred somewhat with the jobs and caused a certain amount of disorder. Particular difficulty has been encountered in reservoir clearing operations above lock and dam No. 26 in the Mississippi River at Alton, Ill., and on a flank levee improvement project being carried out by the East Side Levee and Sanitary District of East St. Louis. A number of other levee projects in the vicinity are threatened with trouble. WPA workers are being paid 44 cents an hour on the Missouri side and 50 cents an hour on the Illinois side of the river, whereas the union scale for common labor is 67½ cents an hour.

SKILLED LABOR in the St. Louis area is also involved in a dispute. Union pickets have shut down the work on the St. Charles bridge over the Missouri River, where a $390,000 project for approach widening and bridge repair is being carried out by the Massman Construction Co. of Kansas City, Mo. The Bridge, Structural, and Ornamental Iron Workers Union, A.F.L., objects to open shop operation at the bridge project.

A BIGGER BRIDGE PROJECT has been shut down by labor trouble in Pittsburgh, where work has been halted on abutments and piers for the new $2,500,000 Highland Park bridge. The Pittsburgh Building Trades Council asserts that the Holmes Construction Co., the contractor, is operating under a contract covering all labor on the project signed by an A.F.L. organizer who had authority to bargain only for common laborers. The A.F.L. executive council recently awarded jurisdiction over the skilled laborers to the building trades council.

CARRYING OUT the policy announced at its annual convention (*ENR*, Feb. 10, 1938, p. 199), the Seattle chapter of the Associated General Contractors of America, in conjunction with the Seattle Construction Council, has submitted a letter to representatives of the Seattle Building Trades Council stating that on the first Monday of March and continuing through for eight months, all commercial building construction will proceed on an 8-hr. day and a 40-hr. week with the same hourly wages as heretofore. The building trades council agreed to submit the letter to all its affiliated unions for their consideration. The 6-hr. day and the 35-hr. week has been standard in Seattle for the past year.

Wide World

SECOND DECK FOR HENRY HUDSON BRIDGE

CAPACITY of the Henry Hudson Bridge over the Harlem River at New York City is being doubled by the addition of a second level to the roadway. Each level will be used for one-way traffic.

When the bridge was built it was planned to add the second deck at some time in the future, but traffic was so great that it was decided to proceed immediately with construction of the second level.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

THE PRUDENT INVESTMENT method of valuation would be established through Congressional enactment under the terms of a bill introduced Feb. 9 by Rep. Havenner of California. This would amend the public utility holding company act of 1935 by inserting a new section permitting the Federal Power Commission, in approving interstate rate structures, to use as a basis the prudent investment in used and useful electrical property less accrued depreciation and the credit balances in other reserve accounts, plus a reasonable allowance for working capital.

WESTERN CONGRESSMEN decided at a meeting Feb. 12 to press for increased appropriations for reclamation projects in the Interior Department appropriation bill for 1939, soon to be reported. It was agreed that an appropriation level of $50,000,000 per year should be maintained.

COURT REVIEW of the Federal Power Commission decision that the proposed hydro-electric development of the Carolina Aluminum Co. on the Yadkin River near Tuckertown, N. C., will affect navigation and is therefore subject to federal license has been requested by the company.

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Transcontinental Highways Proposed in Congress

Construction on a self-liquidating basis of ten super-highways, three of them crossing the country from east to west and seven from north to south, is proposed in a number of bills now before Congress.

A bill introduced by Senator Bulkley of Ohio would create a United States Highway Corp. with a stock of $100,000,000 subscribed to by the Treasury and with authority to issue as much as $2,000,000,000 in bonds to mature in 60 years and bear interest rates not greater than 3 per cent. The bonds would be repaid from toll charges on the proposed roads.

The bill provides that highways have a right-of-way at least 300-ft wide and contain from four to twelve lanes, depending on traffic conditions. The roads would be required to have central dividing strips, to eliminate all grade crossings with other highways, and to separate passenger vehicles from trucks.

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Bridge Insurance

Sir: The *Engineering News Record* for November 18, 1937, page 808, contains an item on insurance as taken on Gate Bridge, in which the statement is made that insurance on bridges is of recent origin and that the George Washington Bridge was the first to be insured. Your understanding is rather surprising in view of the fact that all bridges which were financed by private money during the 1920s and since have been insured to support the quality of the bonds.

The first bridge I know of to be insured was the Carquinez Bridge in California financed in 1924; next were the Dumbarton Bridge over the Southern Arm of San Francisco Bay, the four bridges my firm built over the Mississippi River, the two bridges over the Missouri River, the Sandusky Bay Bridge, the Mobile Bay Bridge, the Norfolk Bridge, the Ocean City-New Jersey Bridge and many others of our construction were all privately financed and insurance was taken on all of them. I know also of a large number of others, all of which were privately financed and all insured.

All the bridges loaned for by R.F.C. were insured.

JOHN LYLE HARRINGTON
Kansas City, Mo., January 13, 1938

Buildings That Express New Trends

Sir—Your issue of Dec. 9, 1937, devoted to "Buildings That Express New Trends" was very interesting. The buildings depicted therein using glass block and metal walls are so striking that it is hard to believe otherwise than that this mode of construction will gain adherents in the future.

It occurred to me after reading this issue that if the air was exhausted from the interior of these glass blocks that the heat transfer value would be greatly decreased since the principle of the vacuum bottle could then be used. Direct conduction losses would then be limited to the outer edge of these blocks and to the mortar between them. Without doubt such blocks could be designed to take care of the resultant air pressure without too much difficulty or greatly increased weight.

In this same connection and after seeing how far builders have gone in the use of steel for walls, would it not be possible to form such walls of panels constructed in a manner similar to that of the glass blocks and likewise exhausted of air? If the difficulties of making such hermetically sealed panels of proper strength are not too great, it would seem as though the idea were well worth a trial.

Properly designed compartments might afford a lighter weight and more efficient medium for various insulation purposes. In these days of high steam pressures and long pipe lines, heat losses in transmission are enormous and ordinary pipe coverings are not exceedingly economical. I have seen the snow melted on the ground over a tunnel containing well covered steam lines where elsewhere there was an appreciable depth of it. There may possibly be an economical use for vacuum in certain pipe covering fields. The insulation of refrigerators suggests another possible use.

It is of course understood that there are limitations to the economical uses of such suggestions as these, but it does seem to me that the use of vacuum for various purposes has been greatly neglected. It may be worth the remembering that vacuum is also a non-conductor of sound and, furthermore, that it is available everywhere.

PAUL M. BERKO
Harding, Mass., Jan. 31, 1938

Underground Lakes

Sir: The title of the splendid article on the development of the water-supply for the Timken Roller Bearing Co. at Canton, O., (*ENR*, Jan. 6, 1938, p. 25) refers to the source of the water as "an underground lake." The misconception that large subsurface water supplies (and also petroleum) occur as underground rivers and lakes, instead of as interstitial fillings in porous formations, is still all too prevalent among the general public and is too frequently reflected in newspaper articles and headlines, despite efforts of qualified geologists and engineers to correct it. It is therefore regrettable to find this misconception reflected also in the title of a technical article written by a technical man and published in a technical magazine like *Engineering News-Record* and thereby given apparently authoritative credence. Its erroneous use is more regrettable in view of the fact that actual underground rivers and lakes may and do occur in solution caverns.

GEORGE E. EKBLAW
Geologist and Head, Areal and Engineering Geology Division, State Geological Survey, Urbana, Ill., Jan. 26, 1938

Lift Bridge Not "Ancient"

Sir: Please permit me to take exception to the statement printed on page 1,016 of the Dec. 23, 1937 issue of *Engineering News-Record*, wherein it is indicated that the Great Northern Railway Co. is maintaining an "ancient" vertical lift bridge on a branch line in the eastern part of Montana. The only lift bridge that we have located in Montana in this vicinity forms a part of our railway bridge crossing the Missouri River just south of Snowden, Mont. This bridge was installed in the year 1913 and is designed to carry Cooper's E-60 loading. The lift span referred to is a modern vertical lift type 296 ft. long and is supported on concrete piers that extend to a depth of about 40 ft. below the bottom of the river.

H. S. LOEFFLER,
Bridge Engineer, Great Northern Ry. Co. St. Paul, Minn., Jan. 5, 1938

A European View on Sewage Salvage

Sir: I should like to make some comment, from the European point of view, on Dr. Rudolfs' article on salvage from sewage (*ENR*, Dec. 30, 1937, p. 1055). Dr. Rudolfs points the way, and probably will lead the

way to more economic sewage disposal, and it seems an ill-advised undertaking to retard him in his course. Luckily, I have not a reputation for conservatism and, moreover, what is right for America is not necessarily right for Europe, and vice versa.

It seems to me that Dr. Rudolfs' viewpoint is essentially a result of, or even a reaction to, the recent history of American sewage disposal. The gigantic accomplishment of sewage purification schemes in the United States during the last few years, being mostly of a purely "destructive" character, is unprecedented. A consideration of the possibilities of utilization is a logical sequel.

In Europe, however, development has been very much the reverse. Justus von Liebig's famous saying: "Von der Lösung der Kloakenfrage Hängt das Wohl der Staaten ab" (The prosperity of nations depends on the solving of the sewerage problem), being the summary of his opinions on the necessity of returning the plant food values to the soil, stood at the cradle of sewage treatment in this part of the world, and its influence has not always been beneficial to the cause of clean streams. The hope for salvage or even profit from sewage has long hampered the development of sewage purification, and even now often stands in the way of the right solution. So, speaking from my own experience, I am inclined to reverse Dr. Rudolfs' final statement in which he says: "The writer believes that the time has come to change our thinking from destruction of waste to conservation and recovery."

The reader will realize that the above statements are rather too drastic, owing to their conciseness. I have always fully appreciated the immense value of the accomplishments in utilization, in the production of gas and of a high grade soil conditioner in particular, and I am confident that research will lead to further developments, as it has done since 1909, when I was first to demonstrate the means to intensify methane fermentation of sewage and sludge for power generation and other economic purposes.

I am not too confident, however, on the subject of the production of other pure chemical substances from sewage sludge. I don't doubt the possibility, or even the feasibility, of such procedures, especially when certain trade wastes constitute an important part in the composition of the sewage, but I think that the production of such chemical substances as mentioned by Dr. Rudolfs, from other cheap materials of a less complicated and a more consistent nature has lately made so much progress, and will make so much progress in the near future, that sewage sludge would not stand a chance.

H. KESSENER

Director, Government Institute of Sewage Purification, The Hague, Netherlands

Hangar Doors

Sir: Your interesting description of the Glen L. Martin Co. Building in your December 9, 1937, number entitled "Getting Ready for Bigger Airplanes" contains one or two statements which will bear modification.

Among the novel features claimed for this building is a new type door, the novel element of the design being that the door is divided along its horizontal center line and that in operation the lower unit is first raised vertically for its full height, in effect telescoping the upper section; then the two units together are pulled upward and outward until they lie flat at the bottom chord level forming a cantilevered canopy outside the building.

The article states the novel element of the above design lies in the fact that the lower door section is raised vertically and is completely opened before the upper section starts to move.

The article then points out the advantages claimed for this type of door due to the method of operation.

It is desired to bring to your attention the fact that the operation of the door you describe is not entirely new, as doors performing the same operations, with added features, have been erected and are in use at the Trenton Airport, located in Ontario, Canada.

The doors at Trenton are operated hydraulicly from the local water system which makes them: (1) Silent. (2) Positive in action with vertical motion of lower half before the door starts to canopy. The lower half can be extended when open to form a full canopy if required. (3) Under absolute control at all times and positively locked when closed. (4) The cost of operation is almost negligible.

We are pleased to bring this information to your attention and trust you will find it of interest as to new methods of operating doors.

J. F. G. ELLARD

The Mis-Can-Ada Manufacturing Co. Ltd. Ottawa, Ontario, January 17, 1938

Stadia Technique

Sir—I read with interest the articles on Stadia technique by Mr. J. A. Oakey and Mr. Milton R. Eva. I have been using, as a matter of course, the method explained by Mr. Eva in the January 27 issue of *Engineering News-Record*. I have used this method for years, but I am not sure where or how I learned it. The method involves the use of mental arithmetic in computing each stadia interval, making it slower than Mr. Oakey's method, perhaps, but it has the advantage of a check on each shot, because the upper half-interval should agree with the lower half-interval. In the course of time this feature will isolate many a mistake in reading stadia wires. The position of a doubtful shot in a sequence, plus remembrance of the "lay of the land" will often determine which half-interval is correct where there is disagreement.

If the surveyor will take the precaution of doubling all traverse shots, and important side shots, by taking one observation with telescope normal and the other with telescope inverted, he will obtain such good closures, both vertical and horizontal, that he will not need to tape the courses of the traverse nor run levels on the stations—for ordinary work, of course.

With a rodman who knows where to take the shots, and an instrumentman with experience, there is very little lost time with the method outlined by Mr. Eva. A target or strip of cloth to mark the H. I. on the rod will facilitate setting the middle wire and thus speed up the work.

Mr. Oakey's technique should prove better adapted to use with the plane table and alidade, especially in flat country, than to use with the transit.

FARWELL V. GLIDDEN

DeKalb, Illinois, January 30, 1938

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FEBRUARY 17, 1937

A GRIDIRON of superhighways up and down and across the United States is not an impossible thought. Highway transport has gone a long way in its thinking in a few years, and the idea has been taken out of the hands of impractical dreamers and advanced toward sound planning by practical highway engineers. From this real advance it is not encouraging to turn to the flamboyant promotion exhibited in the fantastic superhighway legislation being proposed by Senator Bulkley and allegedly favored by President Roosevelt. Three east-and-west and seven north-and-south roads, twelve traffic lanes and mile-wide rights of way, a cost baldly placed at six billions, and tolls or roadside concessions to pay the cost—these are the stuff that dreams are made of. They are not the reasoned thought of engineers or transport managers. The scheme has even less substance when considered as a means of providing immediate construction employment. Favorably as a plan for a system of future national express highways deserves to be regarded, the way of approach is not that conceived by the legislation being talked about in Washington.

Encouraging Progress

SOME WEEKS AGO the National Labor Relations Board ruled that the technical men in the West Allis plant of the Allis-Chalmers Manufacturing Co. should be considered as a separate bargaining unit in labor negotiations even though they ultimately became part of the local union of the United Automobile Workers of America in that plant. At that time these men had their own independent union, the Independent Engineers and Draftsmen's Association. Since then the plant employees have held an election in which the technicians voted to continue their own union as their representative, as provided by the N.L.R.B. Also, the U.A.W.A. has adopted a resolution which puts it on record as approving the arrangement for autonomous action by technical men. This is encouraging progress toward giving engineering employees full freedom of action under the Wagner Act to maintain and protect their peculiar position. So long as they are maintained as a distinct group they can expect to be heard in discussions of rates of pay and working conditions. Every effort should be made to have a like arrangement put into effect in other organizations where engineering employees are but a small minority of the whole organization.

Water from the North

CHICAGO'S RECENT REPORT to the Supreme Court that it can soon cut down its diversion from the Great Lakes to 1,500 sec.-ft. serves to draw attention to another development affecting the water supply of the Lakes. When the controversy over Chicago's diversion was at its height some Canadians urged that that city be required to pay the cost of bringing in enough water from the Hudson Bay drainage to offset the diversion. Now the Ontario Hydro-Electric Power Commission is engaged in an operation that will bring nearly as much water into Lake Superior. Just over the height of land lies Long Lac, its southern tip near Lake Superior but draining northward. The commission is now cutting a channel southward toward Lake Superior, and plans to build a control dam at the old outlet. The immediate purpose of this channel is to bring pulpwood to mills on Lake Superior, but the water will add to the flow at Sault Ste. Marie and at Niagara. It also will increase the power along the St. Lawrence and the low water depth at Montreal. Recognition of the fact that Canada is going ahead with this scheme independently cannot but add to the satisfaction of knowing that Chicago is living up to its pledge.

Truthful Accounting

CURRENT PROBLEMS of the contracting business, as discussed by E. P. Palmer in last week's issue and later debated before the Associated General Contractors, have a direct relation to the citizen's pocketbook because of their bearing on the cost of construction. In the last analysis every item of construction cost must be paid for by the public, and for this reason the public is directly interested in knowing what is the most efficient and economical way in which to carry out a construction job. It is fair to ask, therefore, that when contract construction is compared with day-labor construction their relative costs should be fairly and honestly computed. But present accounting of day-labor construction nearly always falsifies the comparison. Compensation and liability insurance are not paid and not charged when work is done by the day-labor method. Taxes of half a dozen different kinds, falling on the contractor but not on the public agency that uses the day-labor method, are likewise not charged. Present practice, in short, is such as to mislead on the important point of which

construction procedure is the cheapest. In the interests of sound business procedure as well as of his own pocketbook, the citizen is justified in demanding truthful construction cost accounting.

Road Protection Restored

JUDICIAL ENGINEERING receives a salutary setback through the Supreme Court decision that a state may by legislation protect its roads against excessively wide and heavy vehicles. It will be recalled that last Spring a lower federal court nullified a South Carolina law limiting the loads and widths of vehicles (*ENR* Jan. 28 and Feb. 25, 1937, pp. 144 and 310) and that in doing so it undertook to render an engineering opinion on the amount of load that a road pavement can safely bear. The Supreme Court's reversal of this finding may be taken as a veiled rebuke to the lower court for thus going beyond its sphere. More important, it establishes the doctrine that a state has the right and power to protect its roads against abuse and its road users against infringement on their rights and their safety. The no-man's-land of lawless road use that heretofore lay between the bounds of federal inaction on the one hand and state lack of authority over interstate traffic on the other is largely abolished by the decision, and progress toward due traffic regulation is made possible.

Who Pays for Power?

IN THE PAST when a power company built a dam across a navigable river, thus improving its navigability at the same time that a power head was created, no part of the cost was charged to improved navigation; the whole cost had to be carried by the power company, and ultimately by the power users. The equity of that arrangement may be questioned, but it had acceptance as a federal policy of long standing. In conflict with it is the new plan devised for combined navigation and power undertakings; its workings are likely to have an important effect on the taxpayer.

A few years ago the government went into the power business, and among the dams it built on navigable rivers was one at Bonneville on the Columbia. That dam will serve both power and navigation, but the cost division remained unsettled. Last week, finally, the Federal Power Commission announced the way in which it proposes to allocate the cost of the dam and power plant. The details are given on another page. Power at Bonneville will bear but 32½ per cent of the cost of the joint power and navigation facilities at the outset; this will result in $11,682,400 of the total of $32,490,700 being charged to power. Ultimately, when the power plant has been completed, power is to bear 57 per cent of the total cost. The general taxpayers must bear the other cost—that is, 67½ per cent of the initial cost of the works and 43 per cent of the ultimate cost.

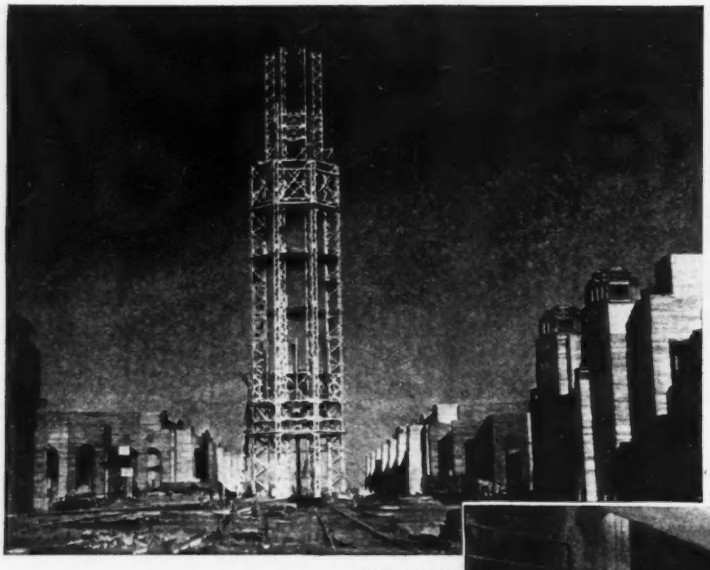
Whatever arguments the Federal Power Commission can produce in support of these allocations, this question stands out: Would the commission have agreed to saddling such a large part of the cost on the taxpayers had the dam been built by private interests? If not—which can safely be assumed—is not the commission putting the federal government in the position of using its sovereign power to subsidize the users of power from Bonneville Dam at the expense of the farmers, the laborers and the merchants of the remainder of the country?

Were waterways put on a paying basis, under a system by which the users would be required to return the carrying charge to the government, there would be logic in dividing the cost of a project like Bonneville between power and navigation. But such is not the case. That part of the Bonneville cost which is charged to navigation is just so much taken out of the federal treasury. The nation has long followed the practice of absorbing all inland waterway costs on the assumption that the waterways cut the cost of internal commerce and so were beneficial to all. Thus, the man in Kansas paid part of the cost of deepening the Hudson River at Albany. Now he is to be asked to pay part of the cost of power used by the fruit growers of Oregon. Likewise he is to share in paying for the power used by the citizens of many towns in Tennessee.

So long as navigation costs are charged against the general taxpayer a more equitable arrangement would be to continue to charge all the cost of dams like Bonneville and those on the Tennessee against power. For, if these dams really cut the cost of transportation on the Columbia and the Tennessee rivers, those who benefit most will be the people and industries of those two river valleys, the people and industries who use the power. And, on the other hand, if no navigation benefits actually result from building the dams, then their only useful purpose is that of generating power, and power revenues should carry them.

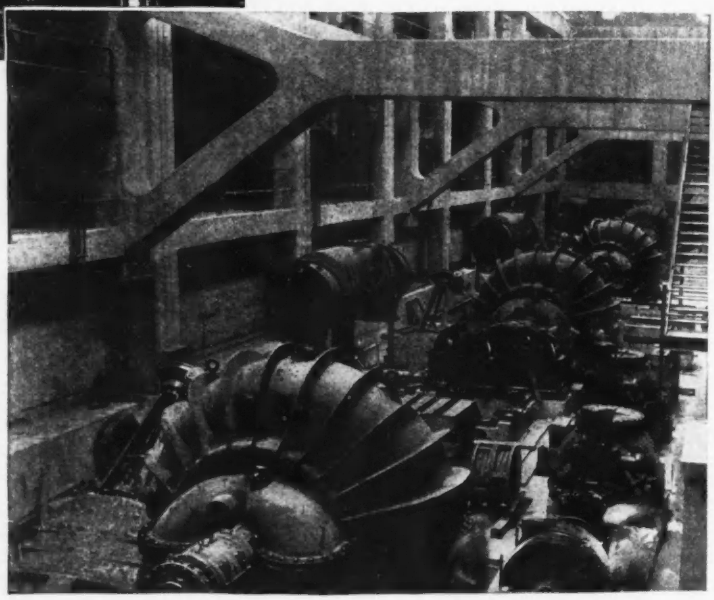
Such an arrangement would not be perfect, but it would be far superior to the method proposed by the Federal Power Commission. It is better to have power costs a little too high at times than to establish a system under which true cost can be concealed by saddling a large part on the general taxpayer. That system will be manifestly unfair to the power companies with whom the government will compete, but its basic defect is that taxpayers in one region can be made to pay part of the cost of power used in other regions, the amount depending on the whim of some federal bureau official.

PICTURES IN THE NEWS

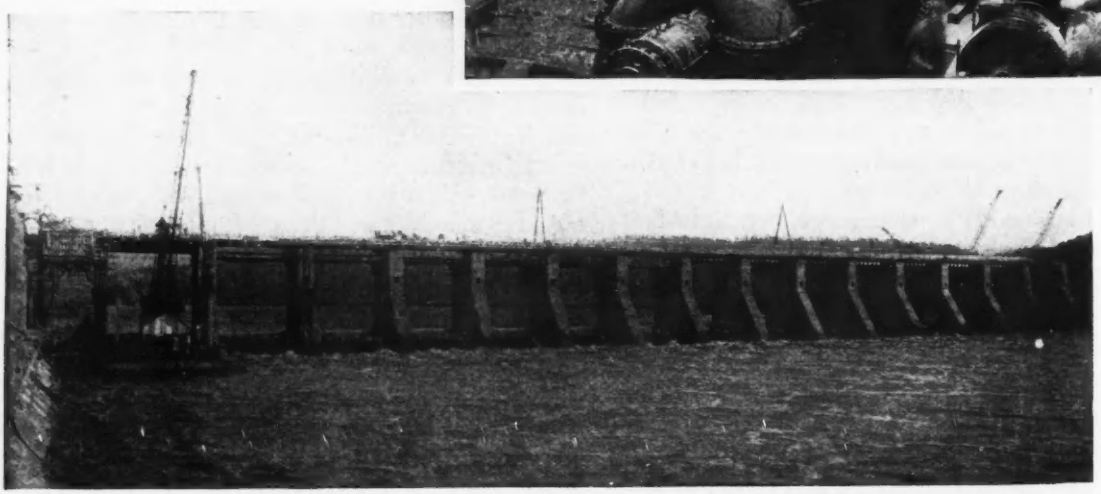


Wide World

SAN FRANCISCO PREPARES for a fair. (Left) In the center the 400-ft. tower to the sun is being erected. This tower and all other buildings of the exposition are being built on the made ground of Treasure Island in San Francisco Bay.



WISHBONES IN SEWAGE TREATMENT. These Y-struts are made necessary by the difference in floor elevation in the main 775-m.g.d. pumping station for Southwest treatment plant of the Chicago Sanitary District now under construction. These 300-sec.ft. pumps are driven by 2,200-hp. high-pressure steam turbines.



SPILLWAY AT GUNTERSVILLE DAM, looking upstream from the lower end of the lock wall. The river is now diverted through the westerly half of the dam while work is in progress in the easterly cofferdam.

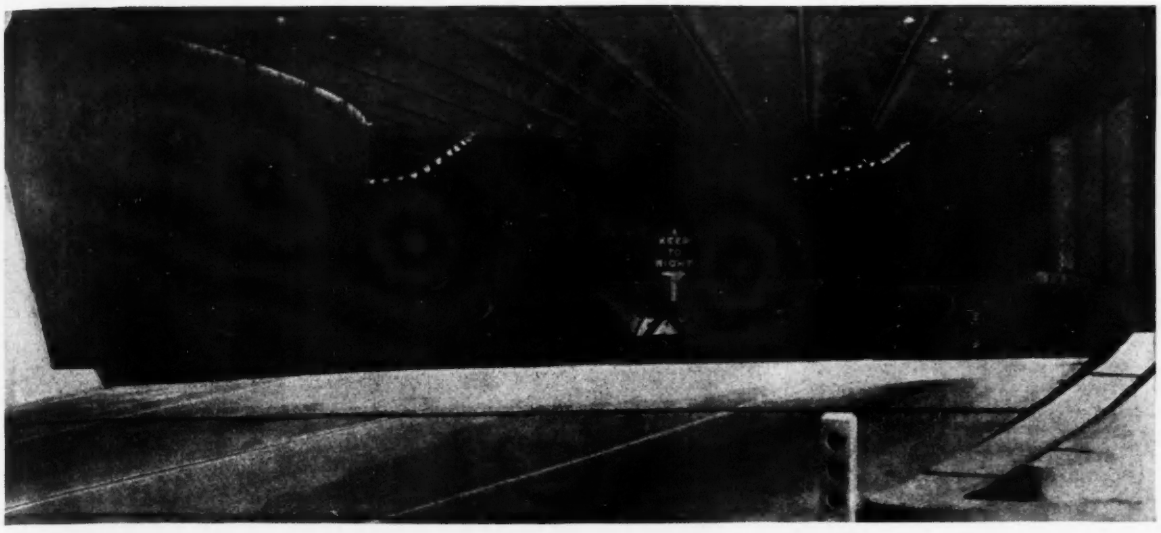


FIG. 1. OAKLAND PORTAL, SHOWING THE "LIGHT TRANSITION" STRUCTURE EXTENDING BEYOND THE TWIN TUNNELS

Light Gradation in Tunnel Approach

Transition from artificial illumination to daylight is designed to avoid motorists' momentary blindness in tunnel at Oakland, Calif.

LOUVERED CANOPIES over tunnel approach cuts protect the eyes of automobile drivers using the Broadway vehicular tunnel recently completed between Oakland, Calif., and Contra Costa County. The idea is a gradual variation of the intensity of daylight that reaches the roadway; beginning with full outdoor strength at the outer end, the degree of diffusion increases until daylight is lowered to practically the same intensity as that provided by the artificial lighting in the tunnel itself. This is accomplished by the mathematical angle at which the vanes comprising the louvered canopy are positioned in respect to the sunlight. Transverse trusses which carry the louvers gave enough support to the retaining walls to make possible simplification of their design and provide a saving equal almost to the cost of the canopy diffuser itself. Another attribute of unusual interest in this tunnel is the ventilation, in which flexibility results from the existence of the double bore. Announcement of the tunnel opening on December 5, 1937 was published in *ENR*, Dec. 16, 1937, p. 966.

Because early morning and late afternoon sun would blind the driver of a vehicle emerging from the comparatively dark interior, Romaine Myers, consulting electrical and mechanical engineer, designed what is probably the first such device for gradual adjustment of the eyes of drivers to the greatly contrasting levels of illumination. Interior lighting by electricity is maintained at 4 foot-candles during the day, which is a high level for tunnel lighting, but to emerge from 4 foot-candles to outdoor intensities of between 300 and 10,000 foot-candles on sunny days is to cause momentary blindness while the pupils of the eye react to the new sensation.

Plotted on the time curve of eye reaction, based on travel at the legal maximum of speed, 45 mi. an hr., Mr. Myers designed a "transition tunnel," or louvered canopy over each entrance to the bore extending 200 ft. beyond the actual portal. This transition tunnel is fabricated of sheet aluminum, mat finished, in small, honeycombed vanes, so calculated astronomically in angle to both the perpendicular and to the latitude and longitude of the site that at no season of the year, or time of day, will any direct light from the sun penetrate to the roadway. Thus a constant North skylight is afforded which allows enough daylight to filter through to provide a gradual transition of lighting intensity from the 4 foot-candles in the tunnel to the outside daylight. In actual operation there is no feeling of adjustment when driving either into the tunnels or out of them at full speed. This in itself prevents traffic hesitancy which might otherwise result in a jam.

Scientific lighting

Interior lighting is controlled by means of refractors so that the prevailing direction of the light is toward the front of the driver and also

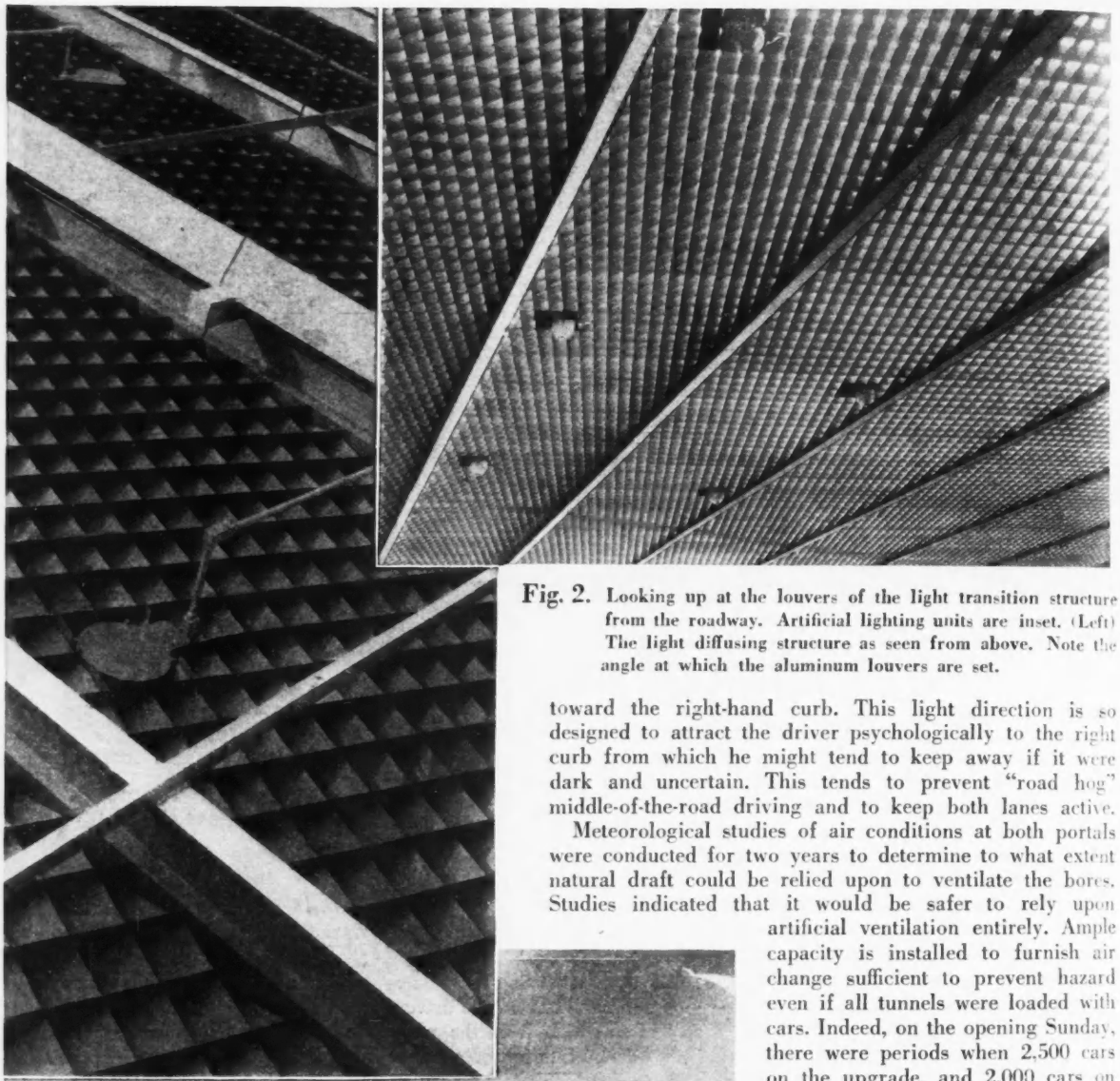


Fig. 2. Looking up at the louvers of the light transition structure from the roadway. Artificial lighting units are inset. (Left) The light diffusing structure as seen from above. Note the angle at which the aluminum louvers are set.

toward the right-hand curb. This light direction is so designed to attract the driver psychologically to the right curb from which he might tend to keep away if it were dark and uncertain. This tends to prevent "road hog" middle-of-the-road driving and to keep both lanes active.

Meteorological studies of air conditions at both portals were conducted for two years to determine to what extent natural draft could be relied upon to ventilate the bores. Studies indicated that it would be safer to rely upon artificial ventilation entirely. Ample capacity is installed to furnish air change sufficient to prevent hazard even if all tunnels were loaded with cars. Indeed, on the opening Sunday, there were periods when 2,500 cars on the upgrade, and 2,000 cars on the downgrade per hr. crept through the two tunnels and the carbon monoxide content was maintained at less than 2 parts per 10,000.

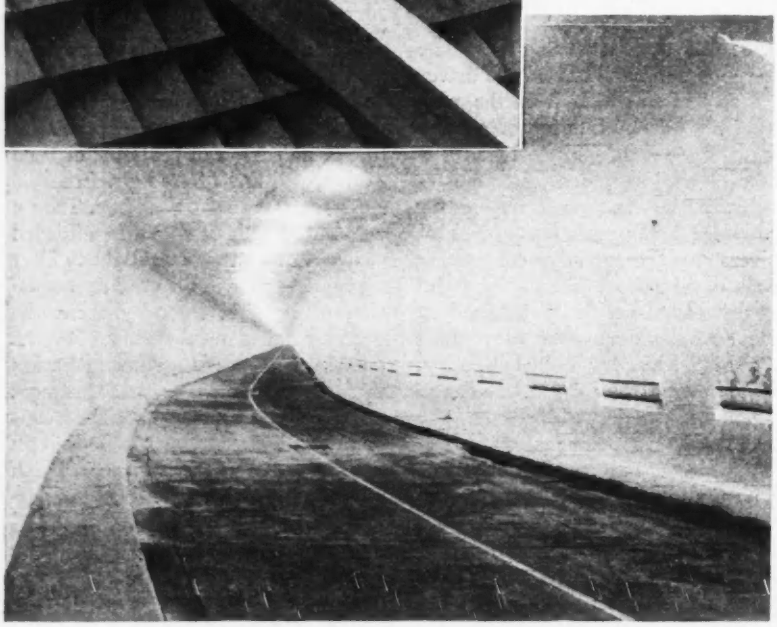


Fig. 3. View looking down the east to west bore. Fresh air is admitted through the slots along the right hand wall. Exhaust air is drawn up through ceiling slots. Lighting intensity is directed toward the right hand curb.

Blower arrangements

Sixteen blower-type fans, four exhaust and four intake to each tunnel, operable at five different speeds, can deliver up to 1,500,000 cu. ft. per min., should it be required. Remote control of the ventilation equipment is centered at the West portal. Photo-electric cell pilots on the lighting units also furnish an automatic means of turning on emergency circuits, should power fail on regular sources.

The two bores are not exactly parallel, for they separate from a dis-

tance of 15 ft. at each portal to as much as 100 ft. through the main portion, with three cross-connections between the two tunnels provided. Each bore is 26½ ft. wide, with a 22-ft. roadway, a 3-ft. sidewalk on one side, and a narrow catwalk on the other.

One tunnel is designed for east to west traffic, the other for west to east, yet facilities are so provided that either may be used for two-way traffic should it be necessary to close off one bore for repairs or maintenance. Sufficient air moving capacity is provided each bore to ventilate that bore adequately in such a contingency. Lighting units are designed to be relamped from the air duct over the ceiling of each bore so as to prevent interference with traffic.

Wallace B. Boggs, was chief engineer for the district comprising the Alameda and Contra Costa Counties.

An Improved Tapping Machine

IMPROVEMENTS in standard tapping machines used for putting 1½- or 2-in. corporation cocks into cast-iron water mains in Los Angeles have materially increased the efficiency of pipe-tapping equipment and methods used on that system. Advantages have been mainly in better connections, although time saved in the operation and decreased maintenance costs are important factors. Mains of 10-in. diameter and more have metal thickness considered safe for connecting 1½-in. cocks; the minimum main diameter for 2-in. tapped connection is 12-in.

It has been found preferable to tap large mains slightly above the mid line. This avoids drawing off debris that tends to float or sink and also avoids unnecessary trench depth. As the taps are put in horizontally a tapping machine that works best in a vertical position may be at a disadvantage. For example, the drill bar which advances the new fitting into the freshly tapped hole will perform this operation satisfactorily in a vertical position but when tapping into the side of a main the 13-lb. weight of a 2-in. cock will deflect the drill bar enough to interfere with exact engagement of the threads. This has been overcome by putting a crosshead or transverse strut on the working end of the drill bar. The crosshead has rectangular notches in its outer ends made to fit guides of corresponding size welded to the inside of the tube in which the drill bar operates. By this provision, sagging of the boring bar is eliminated and the corporation cock is properly guided into the threaded hole.

As most tapping machines are fastened to the main by a single chain and the machine's tapping saddle rests on a rubber gasket, rocking of the machine parallel to the main can easily occur while drilling or threading the hole in the main. This trouble has practically been eliminated by equipping the barrel of the tapping machine with two stout steel braces which are adjusted to seat firmly onto the main. This improvement lessens binding and breaking of the drill tap and insures (1) better threading of the hole through the wall of the main and (2) easier operation of the boring bars. The chain holds the machine so as to prevent any up-and-down movement and the braces prevent rocking parallel to the main.

As most tapping machines are operated by a ratchet whose handle is at right angles to the boring bar, the thrust ordinarily is at right angles to the boring bar and to the machine. This thrust tends to bind the drill and put considerable strain on the tapping machine's fastening to the main. To overcome this trouble in the modified design, a Ford automobile differential is attached to the barrel of the tapping machine. This gearing with a double ratchet makes it possible to revolve the boring bar by pushing and pulling directly to or from the water main (in a plane normal to the center line of the main), thereby practically eliminating side thrust on the boring bar or machine. This arrangement, water officials find, does a better job and makes the work easier, at the same time that it lessens pavement cutting and trench digging.

These improvements were designed and built in the Los Angeles Department of Water and Power shop.

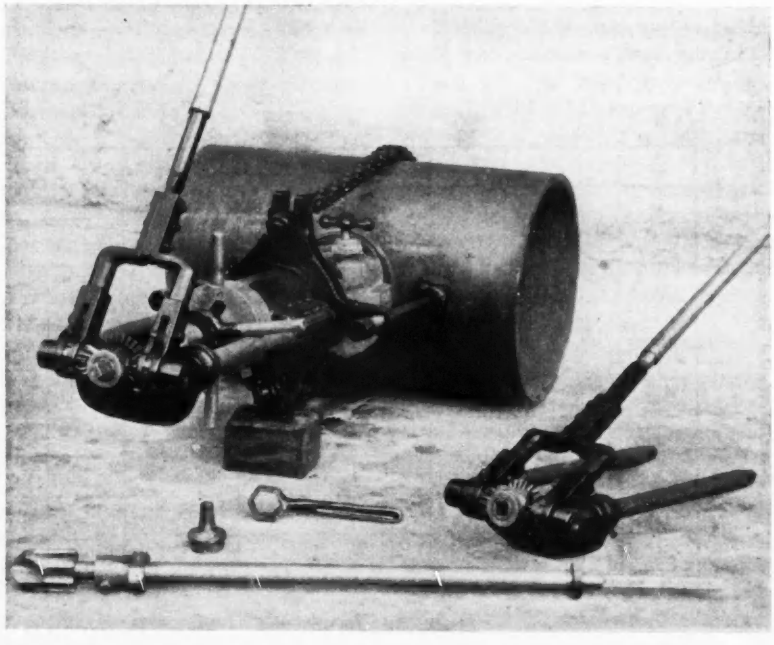


Fig. 1. Standard type of pipe tapping machine rebuilt to use a longitudinal feed ratchet operating through a Ford differential. Note crosshead and guides on drill bar.

Improving Lock and Dam Concrete

by JOHN L. ROHWEDDER

Junior Engineer, U. S. Engineer Office, Rock Island, Ill.

Army engineers in Rock Island district produce new data on air bubbles, sand streaking, mixer design and workability

AS PART of the lock and dam construction in the Upper Mississippi River, many studies have been made by the U. S. Army Engineers of the Rock Island district as to the properties of concrete and the best methods for its placing. Lock and Dam Nos. 10 to 22, inclusive, are being built in the Rock Island District; to date thirteen locks have been completed or are nearing completion and seven dams have been built and six are under construction. The first concrete was placed in 1931. Since that time a great deal of work in field and laboratory has been done for the improvement of the finished concrete. The principal studies to secure better concrete were made on the formation of air bubbles, causes of sand streaking, workability, cement requirements, strength, proper aggregate grading, and the property of water retention of the cement.

In the early work in the Rock Island district, 5 sacks of cement per cu. yd. of concrete were used for the locks, and 6 sacks per cu. yd. for the dams. To lessen the heat of hydration and accompanying temperature cracking with this mix, the specifications were altered requiring 4.5 sacks of coarse-ground cement with 85 per cent passing a No. 200-mesh sieve for subsequent locks and dams. This new mix, which had a low slump and was of an especially harsh nature where crushed stone formed the coarse aggregate, was placed with the aid of electric vibrators. Sand streaking and the formation of air bubbles within the concrete became more pronounced and objectionable with this mix.

Air bubbles occur on the formed surfaces when the air expelled from the mix by vibration does not reach the upper surface of the pour. These air bubbles were sometimes as much as $\frac{1}{2}$ in. in diameter and $\frac{1}{8}$ in. deep. They were objectionable chiefly because they marred the appearance of the structure, and it is not believed that they impaired the soundness.

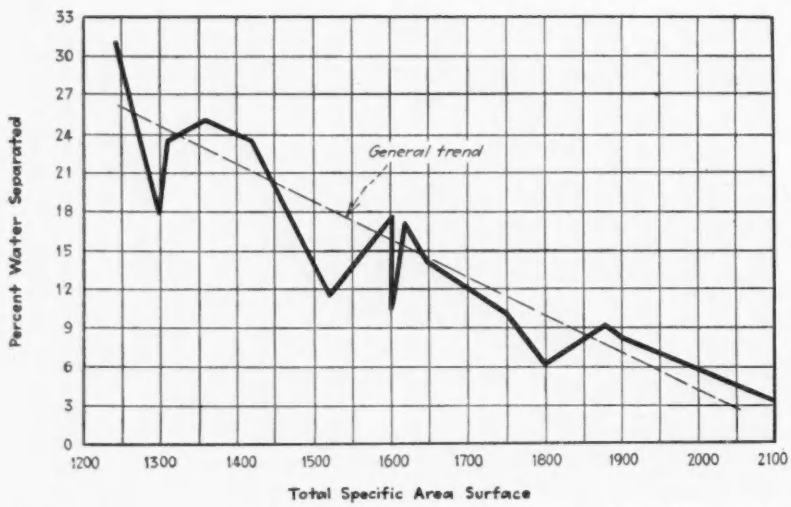


Fig. 1. **Water gain decreases as cement fineness, as measured by specific surface, increases. Lessening the water gain reduces the tendency toward sand-streaking.**

As an aid in studying the formation of air bubbles and finding a method for their elimination, a test form 7 ft. high and 5 x 3 ft. in plan was constructed with a glass plate forming part of one side. In this experimental form a concrete mix containing 4.75 sacks of cement per cu. yd. and a coarse aggregate of crushed stone with the maximum size of 2 in. was placed in 18-in. layers. Different degrees of vibration along the form faces, with and without systematized spading, made it possible to study the effect of those actions upon the finished concrete surface.

From observations through the glass and later inspection of the hardened surfaces, two general trends were noticed: (1) A minimum of air bubbles occurs when the duration of vibration (determined by trial) was varied to suit the consistency of the mix and the vibration was followed by systematized spading along the form faces; and (2) thorough vibration as close to the form face as possible and without spading gave the most satisfactory result for a dry and unworkable mix. Spading a dry concrete created a rough, spotted area over the surface, especially if the mix tended to "bleed" water.

The gradation of materials, water-cement ratio, specific surface area of cement, material from which forms are made, and the thickness of the courses in placement are also important factors in decreasing bubbles.

When the mix is properly designed to give a well-graded aggregate having a maximum surface area, there is less tendency for free water; therefore, less water and trapped air will occur on the concrete face. A

cement of a high specific surface area decreases the water gain or bleeding. Form surfaces that are absolutely tight, as are steel, plywood, or presswood, show more bubbles than tongue-and-groove wood forms, for some of the air and water can escape through the latter by absorption and leakage. Concrete placed in thinner courses is more evenly vibrated, and more air and water are worked to the surface and given a chance to escape. A heavy oil used on wood forms makes them impervious to air and water and therefore increases bubbles. A great improvement in the appearance of the concrete as the work has advanced in the Rock Island district has resulted from a careful study of all these factors.

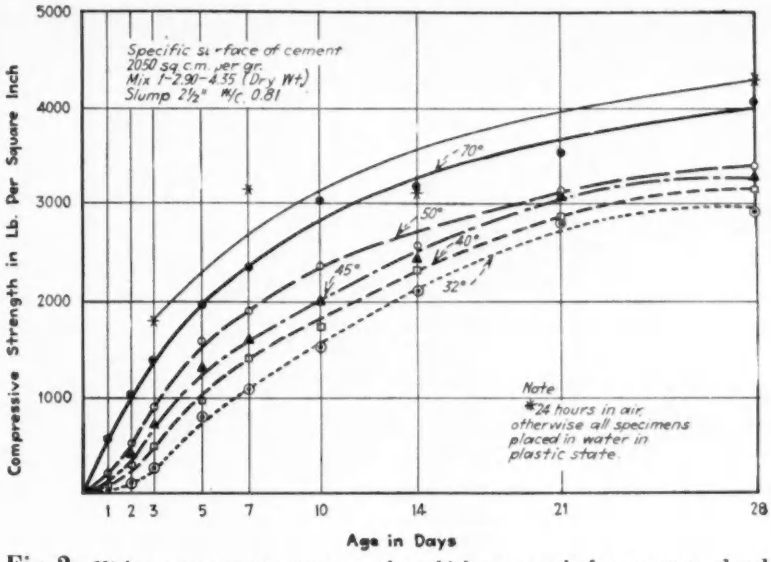


Fig. 2. Higher water temperatures produce higher strength for concrete placed under water. If 24 hr. of air curing can precede submersion, maximum strengths are obtained.

Sand streaking and water gain

The property of water separation in cements as related to sand streaking has been the basis of a series of laboratory tests at Rock Island. In the lock and dam construction since 1931 it has been shown that sand streaking is produced primarily by the water separation or "bleeding" tendencies of some cement. Freezing and thawing and compression tests were made of concrete containing cements with extreme ranges in water retention. These tests showed that while sand streaking may make the surface concrete unsightly and reduce its resistance to frost action, there is no appreciable difference in compressive strength or durability of the concrete forming the interior of the mass.

The property of water separation was studied by placing a known amount of the cement in a graduated glass cylinder with a given amount of water, and after thoroughly stirring for 1 min., the mixture was allowed to remain quiescent for 1 hr. The volume of free water at the end of the hour expressed as a per cent of the total water gave a relative figure for comparing the water separation property of the various brands.

Although the tests conducted on several brands indicated no definite relationship between quantity of water separated from a cement and the chemical composition, specific surface, particle size distribution, and other physical properties, they did show that the quantity of water which would leave a given brand of cement within a given time varied with the specific surface of that brand of cement; the higher the specific surface the less water gained. This relationship is shown by Fig. 1.

Other conclusions reached were: That the lower the water-cement ratio the smaller the per cent of water given off in a given time; that within the limits of the test no relationship exists between the quantity of free lime, silica, tricalcium silicate, tetrocalcium alumino ferrite, dicalcium silicate, or tricalcium aluminate and the amount of water gained in the different types of the same brand; that no relationship could be noted between the time of set and water gain for different types of the same brand. It is probable that the rate and method of cooling the clinker, nature of raw materials, temperature of burning clinker, and variation in the other manufacturing processes are influential factors affecting water gain.

During 1934 the specifications required a coarse grind cement having 85 per cent passing the No. 200-mesh sieve. The specific surface of the several brands of cements used varied between the limits of 1,100 and 1,600 sq. cm. per gr. and, with but one exception, more or less trouble resulted from water gain and sand streaking. Although not required by the specifications, in 1935 cements, with the specific surface varying between 1,750 and 2,100 sq. cm. per gr., were used, and these brands gave little trouble from water separation or unsightly sand-streaked surfaces. Because of the increased ability of the cements with higher values of specific surface to retain water, the 1936 specifications required that the specific surface should vary between 1,700 and 2,200 sq. cm. per gr.

Cements showing an unusually strong tendency for water separation in the laboratory tests were found to cause the most trouble from "bleeding" in the field, and those cements considered "non-bleeding" in the field showed good water retention properties in the laboratory. It is considered possible that in the near future it will become general practice when writing specifications for lean-mix and mass-construction concrete to designate the specific surface and water separation properties of the cement as an aid in obtaining a workable mix with minimum "bleeding."

Workability

A laboratory investigation was made to determine the relation between the miximum size of aggregate and quantity of cement required to produce a given workability; the effect of aggregate size upon a mix of constant water-cement ratio and cement content; and the effect of wet screening or passing a concrete of balanced design through a standard sieve with openings smaller than the maximum size of aggregate.

Although the tests were of limited

scope, sufficient work was done to reach the following general conclusions: (1) For a mix of a given water-cement ratio and minimum cement requirement, the slump of the concrete decreases as the maximum size of coarse aggregate decreases; (2) there is approximately 250 lb. per sq. in. increase in compressive strength for a mix with 4.5 sacks of cement per cu. yd. and 6.5 gallons of water per sack of cement when going from 1½-in. to 2-in. maximum size aggregate, the increase being caused principally by the additional plasticity obtained with the larger aggregate; (3) for a given workability and water-cement ratio, the cement requirement increases as the maximum size of aggregate decreases; (4) for a given slump, water-cement ratio and grading of aggregate, crushed stone has a higher cement requirement than gravel, the quantity depending on the character and grading of the stone; (5) wet-screening a gravel concrete to reduce the maximum size gravel from 2 to 1½ in. has no appreciable effect on the slump of the mix; (6) wet screening a gravel concrete to reduce the maximum size aggregate from 2 to 1½ in. will increase the compressive strength of a 6 x 12-in. cylinder sufficiently to make it equal to that of an 8 x 16-in. cylinder made of the same concrete without screening; and (7) a uniform, well-balanced gradation of the aggregate gives the best results in workability, strength, and economy of cement.

Effect of curing temperatures

Some concrete, notably that in guide wall foundation lifts, was placed under water. For such concrete the specifications allowed a minimum water temperature of 45 deg. F. A series of tests was made to determine the effect of water temperatures ranging from 32 to 70 deg. F. on the compressive strength of concrete when placed and cured in water.

The test specimens were 4 x 8-in. cylinders cast in paraffined paper molds. A series of tests was made with a cement which had a specific surface of 2,050 sq. cm. per gr. and then was repeated for a cement with a specific surface of 1,800 sq. cm. per gr. The mix for each test was 5 sacks of cement per cu. yd. of concrete and 5 gal. of water per sack of cement. The aggregate, which was of 1 in. maximum size, produced a slump of 2½ in. Sufficient test specimens were made to test 6 cylinders for each brand of cement at nine different ages ranging from 1 to 28 days. The cylinders were placed and cured in water at 5 constant temperatures ranging from 32 to 70 deg. F.

Fig. 2, where compressive strength is plotted against age, shows the results for the cement with a specific surface area of 2,050 sq. cm. per gr. Similar results were obtained for the second cement.

The tests showed that there is not a definite setting of the concrete for small size specimens placed in water at a temperature of 32 deg. until after 24 hours. It was thought that the increase in strength per degree gain in temperature from 32 to 40 deg. F. would be very small compared to the per cent of gain per degree from 40 to 70 deg. F. However, after the first 24 hr., the amount of gain in strength per degree rise was almost as great for the first range in temperature as for the second.

A group of specimens was cured in air for the first 24 hr. and then placed in water at 70 deg. F. Fig. 2 shows that this method produced a compressive strength 500 lb. per sq. in. higher than where the specimens were placed immediately in water.

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WPA Reconditions Old Buildings For Municipal Housing

THE PRESENCE, in a town of 500 houses, of 100 decrepit and tax-free residences has long provided a serious revenue problem for the town of Brooklawn, N. J. The problem is now being solved, and at the same time low rent housing facilities are being provided for residents of the town, by means of $28,000 WPA project for reconditioning buildings.

Three hundred houses were built in Brooklawn by the federal government during war time to house workers at the New York Shipyards at Gloucester City nearby. The houses were sold to the workers, with the government holding mortgages. After the war, when workers have moved away, it was necessary to foreclose the mortgages.

Of the original colony 200 homes were sold by the government to private citizens, and therefore became subject to a municipal tax. However, the remaining one hundred houses, abandoned, and, because federally owned, tax-free, were scattered among the privately owned residences, and the town had therefore to pay the expense of municipal services to the entire area.

Under the WPA project the town is purchasing the houses at a nominal cost from the federal government. The houses are then reconditioned, with the WPA providing labor and the town providing materials. The city, maintaining title to the houses, rents them to the citizens at an average rental of about $24 per month.

It costs about $480 to recondition each of the houses. They are two-story, five-and six-room stucco and brick houses. Reconditioning includes cleaning, painting, installation of new heating and plumbing facilities, replastering and landscaping.

The town has made arrangements to purchase materials on a credit basis and make the payments as rents come in. Although the houses are still tax-free, the income from rentals more than equals tax income. Thus, the average house rented at $24 per month returns $288 per year; an estimated maintenance cost of $100 gives a net return higher than the present tax rate of about $100.

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Milwaukee Sludge Sales

THE MILWAUKEE SEWAGE plant sludge is again returning substantial sums to the sewerage commission. James L. Ferebee, chief engineer, in asking the city council for operating money for next year reported that Milorganite, processed activated sludge, is now selling for about $20 per ton. In 1935 it was sold with difficulty at one-half that figure and the year's proceeds were $370,000. This year he estimated $850,000 would be obtained. This sum plus $500,000 from the city will make up the operating expense.

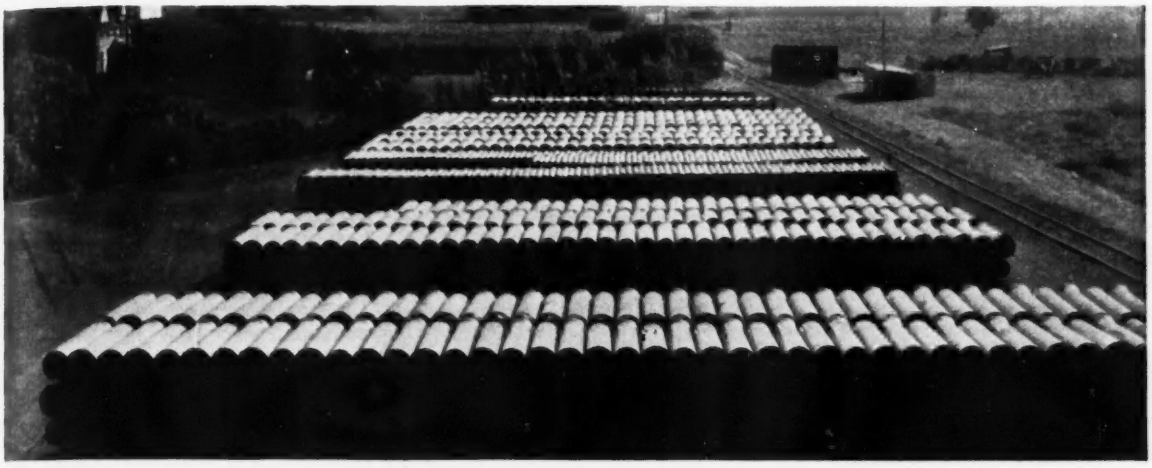


FIG. I. DES MOINES KEEPS A GENEROUS SUPPLY OF PIPE ON HAND FOR EXTENSIONS

Waterworks Operation at Des Moines

by W. W. DeBerard
Associate Editor, *Engineering News-Record*, Chicago

Thrift, orderliness and excellent grooming characterize operation of the municipal water purification plant at Iowa's State capital

UNDER MUNICIPAL CONTROL for 18 years the waterworks of Des Moines, Ia., has retained many of the qualities with which corporation control is usually credited. This is largely due to the personnel carry-over, particularly of the late Charles L. Denman, who brought with him from New England ideas of thrift, orderliness and above all a feeling that municipal structures and grounds should be made ornamental as well as serviceable. The waterworks pumping station in consequence is set in one of the finest parks of the city and bears an enviable national reputation for its attractiveness which is maintained by an experienced grounds keeper whose pride is the several hundred acres of park area, fish ponds, fountains, a bird sanctuary and numerous picnic spots with grills. Since the supply is obtained from galleries in the flat broad Raccoon River Valley, which is from 1 to 2 miles in width, the surface can be maintained for park purposes with the exception of areas over the galleries, which are flooded during the last six months of the year by pumping from the river and from the 2-billion gal. Kildeer reservoir.

With this background it is not surprising that the services are 99½ per cent metered. All domestic meters are overhauled at least every 2 years and sizes up to 2-in. receive attention every year. Hydrants are checked over once a year by a 2-man crew and intensively in winter by twelve "hydrant walkers" taken from the summer construction crews. Emergency requirements are anticipated in a truck always ready for service.

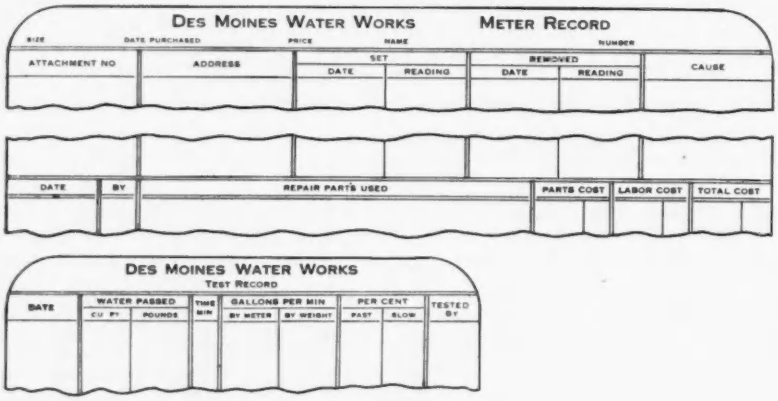
Records of meters, materials and stock are carefully kept. Maps and pertinent records are duplicated, one set kept in a vault at the city office and another in the engineering office at the pumping station. In a well-equipped laboratory coal and water tests are made continuously. Pumps and steam turbines are watched for efficiency. Walls and floors in the boiler room are painted at three- and two-year intervals, respectively, with oil paints. A carpenter shop, a blacksmith shop and a machine shop are well-tooled. Automotive equipment is washed every night after use, painted when needed and traded in when upkeep costs exceed the interest of the added investment that would be made for new machines.

Meter test procedure

The usual tolerance of 2 per cent variation on large flows is adhered to in resetting meter trains after test, cleaning and repair. For small flows, 1/16 in. stream, 5 per cent variation is considered not out of line and for 1/32 in. stream the meter must register. Most meters, 99 per cent, the manager says, are brought in for test on complaint or because the meter readers found them slow. (This is contrary to the experience in Cedar Rapids where most meters out of line are found "fast"). Adjustments are made after tests have been run and a new meter installed for a period. Records of domestic service readings and billings are available on individual service sheets so that the adjustment clerk has a long time view of the customer's account. It is the duty of one clerk to scan each bill to check any irregularity.

Meter readers are supplied with looseleaf books having metal covers filed at the service office on the

Fig. 2. A lasting legacy in the way of attractive buildings in a beautiful park setting was left to Des Moines by the late Charles L. Denman.



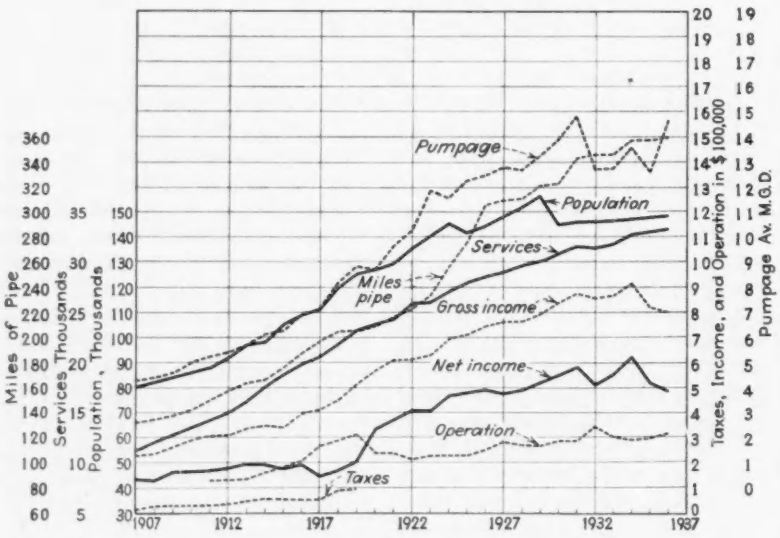


Fig. 3. (Top) Meter history forms have test records on back side. They are filed by size and number. (Bottom) General statistics of system for thirty years.

pumping station grounds. It is a simple record sheet 4 in. wide and 10 in. long perforated and bound at the top of the 10-in. dimension. The name of customer, address and location of meter heads the four ruled columns in which are recorded the date, reading and meter number. Spaces for 36 readings (3 years) are available. To simplify subtractions entries of readings start at the bottom of the sheet. Meter number is essential since the city owns and maintains the meters. Replacements are made at the time a meter is taken out for test hence the same meter rarely gets back at the same address.

Record system

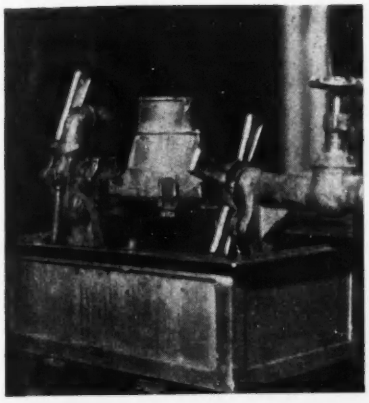
A daily report of all meters set and removed is kept along with the dial reading before and after test so that the meter reader's record is checked. On this daily sheet are three groupings: those reset on old accounts during the day; those repaired; and those on new accounts. Headings include address, account number, size, make and number, reading and cause for test. The record is kept on a 9x11-in. sheet perforated on the 9-in. edge for a looseleaf file book. Postings are made each day to a 5x8-in. individual meter history or record card on which is noted the details of the test, repair parts used and costs. When meters are purchased a record is started on a separate card which shows size, date purchased, price, name and number.

A 12-meter testing rack is provided at one end of the testing room where a foreman and three mechanics test and repair meters. Gear trains are repaired, separated and stored in paper bags.

Per capita consumption averaged 98.6 gal. in 1936 and 85.3 gal. in 1935. This is 40,700 and 35,300 gal. per mile of pipe respectively for the two years. Population served is 150,000 through 33,358 services (1936). Quantity billed from meters is 68.8 per cent of that pumped, which does not include municipal uses enumerated under an impressive list of two dozen items in the 1936 report of the manager. The items are fire protection, flushing and cleaning sewers, snow flushing, cleaning streets, sprinkling streets, water used at fire stations, city parks, municipal golf courses, all municipal swimming and wading

pools, city-owned buildings, city construction work, PWA and WPA projects, watering troughs, city drinking fountains, filling cisterns, waterworks plant operation, car washing, blowing off water mains, leakage and broken mains, meter under-registration, meter testing, etc.

Record maps, both blueprints and tracings, are kept at the field office at the pumping station rolled on ⅝-in. sticks in metal cabinets. A number on a label on the end of the stick identifies the maps which are arranged in numerical order under suitable heads. A corresponding number on a card which is cross-indexed is the means of entering the map file. These maps are now being duplicated and sent to the vaults of the city office as a precaution against loss by fire.

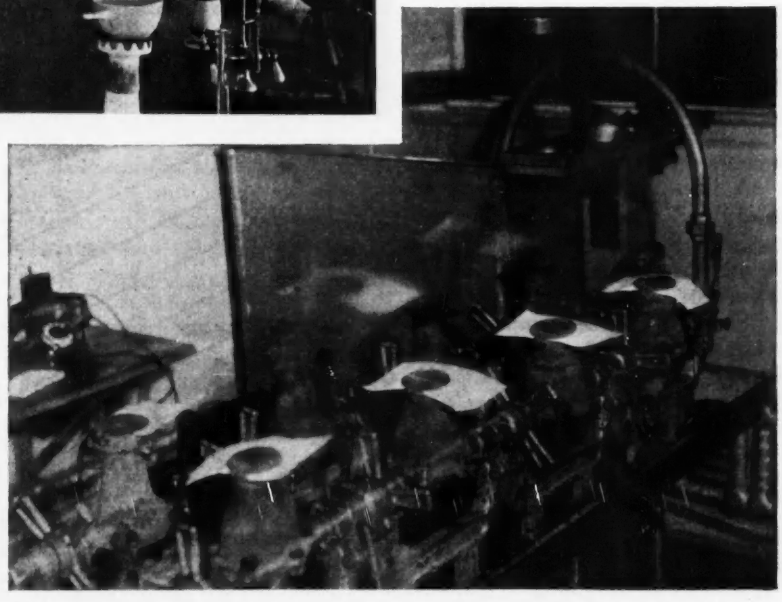


Sectional blueprint maps pasted on stiff cardboard and then varnished, showing the mains, valve and hydrant locations, are provided for the emergency car which also has a duplicate book showing in detail, location, dimensions of mains, valves and special underground structures.

Coal samples for testing are taken of every 1,000-lb. weigh-lorry load by a bucket into which a small stream of coal is passed as it discharges into the stoker feed hopper. These samples are pulverized in ball mills rigged up to be driven by a belt from the stoker mechanism. The mills are porcelain jars, about a foot in diameter loaded with flint pebbles. Ash is sampled for combustibles, averaging 10.8 per cent in 1936. The coal is a low grade Iowa bituminous coal averaging 8,875 B.t.u. as fired and 11,314 B.t.u. dry. While coal is not bought on a B.t.u. basis but in the open market record of tests is kept for future purchases and figuring plant efficiencies.

Bacterial samples are made each day from six points. Quality is excellent. No B. coli are found and two out of three samples incubated at 37 deg. C. show no bacterial count. The 1936 daily tap water samples in town showed an average of 0.403 bacteria per milliliter at 37 deg. C.

Chlorine equipment is maintained in a closed room provided with an exhaust fan for emergency leakages.



Semi-monthly sanitary chemical tests are made on samples from the river, gallery manhole, pumping station and downtown areas.

Mineral analyses, made quarterly, generally show 425 p.p.m. total residue, 299 bicarbonates, 106 sulphates, 17.5 free CO_2 and 7.13 pH. Total hardness, taken daily, ranges from 12 to 22 grains per gallon. Temperatures, now of increasing importance for air conditioners, run below 60 deg. F. prior to the middle of July then rapidly increase to 70–75 deg. until late in October. This rise is due to flooding over the galleries with river and lake water after July 1. The city water is therefore not particularly desirable for air cooling.

Financial facts

Distribution of the $808,000 operating revenue for 1936 was made as follows: Operation and maintenance, 39.4 per cent; depreciation, 14.25 per cent; interest and sinking fund requirements, 43.99 per cent; invested capital, 2.38 per cent. Book value of the plant has been built up to $8,350,000 since its purchase for $3,480,000 in 1919. A depreciation of $1,700,000 for this period brings the fixed assets as of Dec. 31, 1936 to $6,650,000. Bonded indebtedness of $4,878,000 exists but is being amortized by a sinking fund derived from earnings of the waterworks.

Fig. 4. (Top) Work bench testing rack for ½- to ¾-in. meters. (Center) Laboratory where water, coal and other commodities are tested. (Bottom) Twelve ½- to ¾-in. meters can be given final inspection on this rack.

Plotting Column Steel Curves

by JAMES R. BOLE
Structural Engineer, Long Beach, Calif.

A procedure for designing reinforced concrete columns for combined bending and direct stress in accordance with the new A.C.I. building regulations

THE code of building regulations for reinforced concrete adopted in 1936 by the American Concrete Institute and later incorporated in many building codes makes several changes in the previously accepted formulas for designing concrete columns. For example in columns subjected to combined axial and bending stresses the gross area of the columns is used and the maximum permissible compressive fiber stress is increased as the bending moment increases in relation to the direct load. These changes make it difficult to use the many diagrams, available in various textbooks, by which eccentrically loaded columns previously have been designed. This article presents a method of preparing curves from which, knowing the bending moment and the direct load and assuming the size of the column, the required amount of reinforcement may be directly determined.

All symbols and notations are the same as used in the A.C.I. regulations with the following additions:

P_o = allowable direct load on a column that is subjected to no bending moment.

P_1 and M_1 = the allowable direct load and bending moment on a column when the moment is of such magnitude that there is zero stress at one outside face of the column.

P_2 and M_2 = the allowable direct load and bending moment on a column when the moment is of such magnitude that there is zero stress at the neutral axis of the column.

A_T = the transformed area of a column.

I_T = the transformed moment of inertia of a column.

D = the side dimension of a square column.

Concrete is assumed to have no value in resisting tension. Also the vertical reinforcing is assumed to be distributed in a thin shell whose diameter is 4 in. less than the outside diameter of the column. The fact that the reinforcing displaces a certain area of concrete is considered in computing transformed areas and moments of inertia, but is ignored when computing allowable bending moments.

The following equations have been derived for square columns, spirally reinforced.

$$A_T = D^2[1+(n-1)p_s] \quad [1]$$

$$I_T = \frac{D^4}{12} + \frac{(n-1)p_s D^2(D-4)^2}{8} \quad [2]$$

$$\frac{c}{R^2} = \frac{DA_T}{2I_T} \quad [3]$$

The code formula for P_o is

$$P_o = A_c\,(0.022f'_c + f_s p_s)$$

or for square column

$$P_o = D^2\,(0.022f'_c + f_s p_s) \quad [4]$$

The code formula for f_c in eccentrically loaded columns is

$$f_c = \frac{P}{A_T}K \quad [5]$$

$$\text{where } K = \frac{1+\frac{ec}{R^2}}{1+0.8\frac{ec}{R^2}} \quad [6]$$

As long as there is no tension on any point of the column

$$f_c = \frac{P}{A_T} \pm \frac{Pec}{I_T}$$

When there is zero stress at one face

RESULTS OF COMPUTATIONS FOR PLOTTING COLUMN STEEL CURVES

D	P_g	A_t	I_t	C/R^2	P_o	P_1	M_1	When $f_c = 1200$			K	P_o/A_t	Allow. f_c	P_2	M_2
								P_2	M_2	e					
20	.01	444.0	14,741	0.301	284	158	525	120.0	984	8.20	1.167	640	748	75	614
	.02	488.0	16,149	0.302	348	193	639	120.0	1,169	9.74	1.174	713	838	84	817
	.03	532.0	17,557	0.303	412	229	756	120.0	1,353	11.28	1.182	775	916	91	1,032
	.04	576.0	18,965	0.303	476	264	872	120.0	1,537	12.80	1.188	826	981	98	1,255
	.05	620.0	20,373	0.304	540	300	983	120.0	1,722	14.37	1.193	870	1,038	104	1,490
	.06	664.0	21,781	0.305	604	336	1,102	120.0	1,906	15.88	1.198	910	1,090	109	1,730

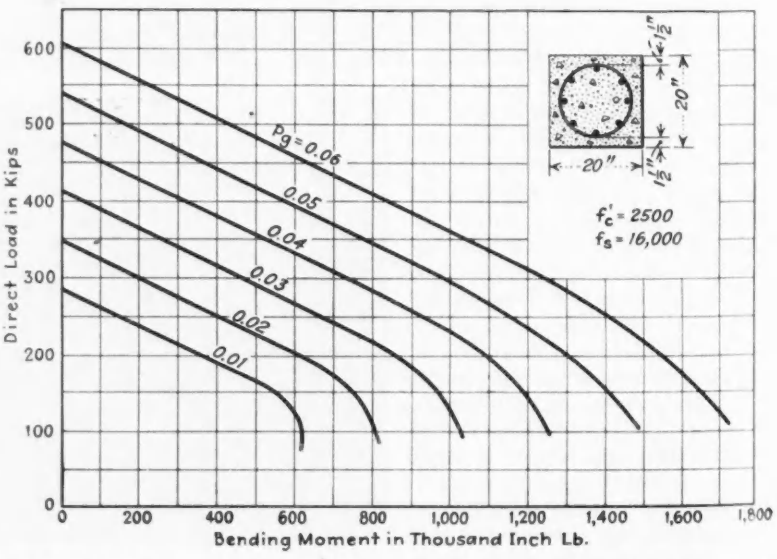


Chart giving steel required in a 20-in. square column subjected to direct loads and bending moments.

$$\frac{P}{A_T}=\frac{Pec}{I_T} \text{ or } \epsilon=\frac{R^2}{c} \quad [7]$$

Substituting this value of e into equation [6]

$$K=\frac{10}{9} \text{ and } f_c=\frac{10P_s}{9A_T} \quad [8]$$

$$\text{Therefore, } P_1=\frac{10P_s}{9A_T}\times\frac{A_T}{2}=\frac{5P_s}{9} \quad [9]$$

$$\text{and } M_1=P_1\times\frac{R^2}{c} \quad [10]$$

When there is zero stress at the neutral axis of the column the direct load resisted by the concrete $=\frac{f_cD^2}{4}$

Since the steel on one side of the neutral axis is in tension and the steel on the other side is in compression, the net direct load resisted by the steel is zero.

$$\text{Therefore } P_2=\frac{f_cD^2}{4} \quad [11]$$

The moment resisted by the concrete

$$=\frac{f_cD^3}{12}=M_{2c} \quad [12]$$

The moment resisted by the steel

$$=\frac{f_snp_sD\,(D-4)^2}{4}=M_{2s} \quad [13]$$

$$\text{Therefore } M_2=M_{2c}+M_{2s} \quad [14]$$

To find the allowed value of f_c at this point proceed as follows: First, solve equations [11] to [14] using any desired value of f_c. Then find e by dividing M_2 by P_2. Substitute this value of e in equations [5] and [6] to get allowed value of f_c.

The true values of P_2 and M_2 can now be obtained since they vary directly as f_c.

P_o, P_1, M_1, P_2, M_2 should be computed for various values of P_g, and these values plotted on a rectangular coordinate chart with one axis representing moments and the other axis representing direct loads. Connect the point P_o with a straight line to the point P_1M_1 and connect P_1M_1 with a curved line to joint P_2M_2. These curves, for all practical purposes will be sufficiently accurate without determining any intermediate points.

The accompanying table shows the computation necessary to construct the curves for a 20-in. square column for percentages of steel varying from 1 to 6. The diagram shows these curves plotted for $P_g = 0.01$ to $P_g = 0.06$.

This same method may be used for constructing curves for tied columns or for round columns with spiral reinforcing. A different set of curves must be prepared for each size column and for each grade of concrete and reinforcing steel. However, these curves can be computed and constructed by inexperienced men and in the design of any large building, where usually only one grade of concrete and steel is used, it should prove economical to prepare at the start curves of this type covering the range and types of columns that will be used.

Servicing a Sludge Digester Tank

Precautions taken in draining a tank and restoring lost efficiency to the sludge heating coils

TAKING a sludge digestion tank out of service for repairs is a difficult and dangerous business if proper precautions are not observed. The principal hazard is the presence of so-called "sewer gas," a combination of hydrogen sulphide, methane and other gases generated by digesting sludge which are not only toxic but explosive as well. Before work can be started it is necessary to remove the sludge and purge the tank of all traces of gas.

How this job was done with safety and efficiency at the DeKalb, Ill. sewage treatment plant, is described by Donald E. Henn, Superintendent, in a recent issue of *The Digester*, quarterly publication of the Illinois State Department of Health. Mr. Henn's problem was to remove a coating of sludge that had baked on the heating coils in the tank, and which reduced the transfer of heat from the pipe to the tank contents. It was necessary to drain and service this unit without interfering with the operation of the plant and to put the digester into service again with minimum delay.

The first step was to dig a large shallow hole to serve as a temporary sludge lagoon and to provide two tanks for the storage of ripe sludge. The sludge in the digester was then drawn to the storage tanks and all the supernatant and scum were pumped to the sand drying beds. The digester was then filled with plant effluent to purge it of its gas content.

After the tank was drained a 1,200 cu.ft. blower was placed over one of the manholes to blow air through a 20-in. pipe reaching to the bottom. This gave a theoretical change of air every 18 min. and the blower was operated continuously for 40 hours before any attempt was made to enter the tank. The blower was not stopped until the work was completed. To test the condition of the air in the bottom of the unit before anyone entered, several sparrows were trapped and lowered into the tank and left there throughout an entire day.

When the tank interior was examined it was found that the baked sludge on the heating coils averaged $\frac{5}{8}$-in. in thickness and was made up of definite laminations. No difficulty was experienced in breaking off this cake, less than 8 man hours being required to clean 380 ft. of $1\frac{1}{4}$-in. pipe.

The heating coil consisted of three rows of pipe, hung on the inside wall of the tank, each pipe being 125 ft. long. To this was added a row of 2-in. pipe connected to the existing coil so that all the hot water would first pass through one of the $1\frac{1}{4}$-in pipes, then a second time through the 2-in. It is estimated that this would increase the heating capacity by about one-half. The additional heating pipe was installed as an aid in maintaining proper temperatures during the severe winter months. Previously it was necessary to carry too high temperatures in the pipes in order to get an adequate amount of heat transfer and this accelerated formation of the sludge cake on the pipes. The entire job was taken to completion in nine working days.

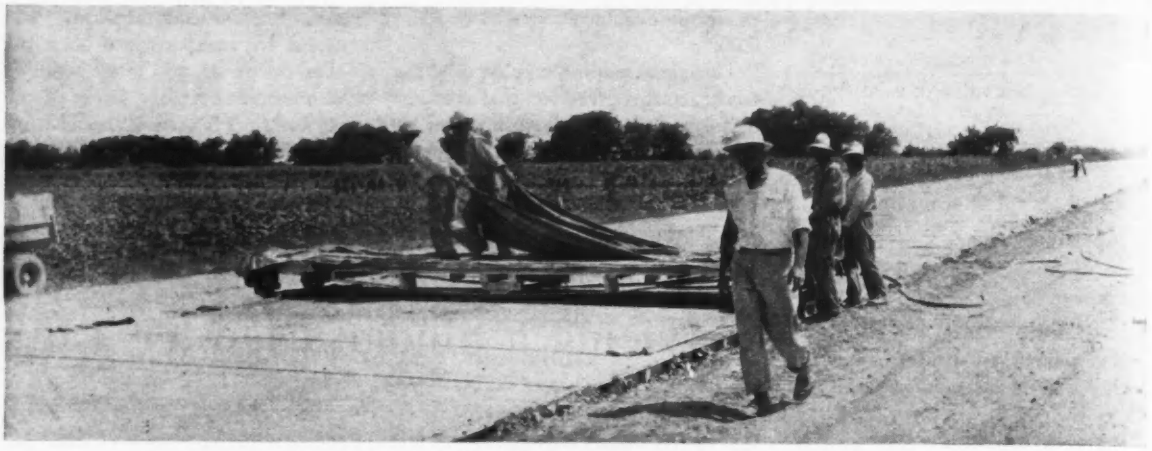


FIG. 1. SPREADING COTTON CURING MATS ON A CONCRETE ROAD

Cotton In Roadbuilding

by LAWRENCE MYERS

Chief, Marketing Section, Agricultural Adjustment Administration, Washington, D. C.

Cotton cloth assumed a prominent experimental role in the roadbuilding of 1937, being widely used for surface reinforcement and for curing purposes

DURING the last two years cotton materials for the surfacing of roads and airport runways, for curing concrete pavement and for lining irrigation ditches have been used in some 35 states. This wide use has come from new agricultural legislation, specifically Section 32 of Public Act 320 (August 1935), which empowers expenditures by the Secretary of Agriculture for experimentation in new and improved uses for cotton and other agricultural products. Primarily two lines of experimentation in 1936 were decided on. One was the use of cotton mats for curing concrete and the other was the use of cotton fabric as a reinforcing membrane in the construction of thin bituminous surface-treated roads. The extension of the experiments to airport runways and to ditch lining followed later. Briefly, for road-work it was provided that:

The federal government, through the Cotton Marketing Section and with the cooperation of the Bureau of Public Roads, in accordance with the provisions of the legislation, shall make available to the highway departments of the various states such supply of cotton mats and cotton fabric as may be requested in amounts sufficient for adequate trials and demonstrations. These materials will be made available to the states on condition that the state highway department agrees to use them, or have them used, in an approved manner in road construction, and also upon the condition that the highway department uses reasonable diligence in securing and recording such information as may be necessary for a future evaluation of benefits derived.

Concrete curing mats

Cotton mats for curing concrete roads were developed by the Bureau of Public Roads and the Texas State Highway Department. The experimental work was reported in the July 1933 and November 1934 issues of *Public Roads*. As the procedure was developed the mats are laid directly on the fresh concrete and are thoroughly soaked with water. They can be removed after 72 hours. Because of the ability of the mats to retain moisture, one wetting per day is sufficient for the curing process. This, of course, reduces labor costs and introduces economy in areas where water is not readily available or is costly to obtain. In the curing process the mats materially lessen the effect of varying air temperatures on the temperature of the curing concrete. They offer considerable protection against freezing and can be used to prevent freezing of the ground prior to the pouring of the concrete. The experimental results show that concrete cured by the use of mats has a high compressive strength.

The mats used in the program were filled with bats weighing 12 oz. per sq.yd. which were made from low-grade cotton or high-grade waste such as card strips. The covering material of the mats was 7-oz. 40 in. cotton Osnaburg. This is a coarse fabric which can also be made from the cheaper grades of cotton and card strip waste. A flap 6 in. wide was constructed along one side of each mat by sewing together the covering material without filling; when in use each mat was lapped over the flap of the adjacent one to insure complete coverage of the concrete. The mats were about 6 ft. 3 in. wide including the 6 in. flap. For pavements 20 ft. wide the mats were made 22 ft. 6 in. long to permit them to extend over the edges of the pavement and to allow for shrinkage when the mats were wet. For narrower roads or roads constructed one side at a time, shorter mats are used.

One of the major problems in-

volved in the use of cotton mats for curing concrete is the cost of the mats. At the time the program was first being contemplated the mats apparently would have cost around $6 each for the 22½ ft. length, since they are not widely manufactured. As a result of purchasing them in rather large quantities on a bid basis, the actual cost was about $5 each. One mat will cover about 13 sq.yd. of pavement. Some of the early work done by the Texas state highway department indicates that a mat can be used as many as 100 to 150 times (*ENR*, July 18, 1935). On a basis of using each mat 100 times and an original cost of $5 per mat, the mat cost would be about 0.4c. per sq.yd. of pavement cured. However, at the time these mats were purchased, Middling ⅞ in. cotton was about 12c. per pound as compared with 8c. per pound at present, and supplies of low-grade cotton were comparatively scarce.

The mats were supplied to state highway departments for experimental purposes on condition that they be used for curing concrete roads and that records be kept to determine the life of the mats, curing costs and other pertinent facts. As shown in Table I, 23 states took a total of 89,535 mats. These mats were used extensively in curing concrete pavement in 1937, either by the states themselves or by contractors to whom they were loaned. In Texas 136 mi. of concrete were cured by the use of these mats. The American Association of State Highway Officials has under consideration specifications for the construction of mats for this purpose.

Road fabric

Experimental work to determine the value of cotton fabric as a reinforcing membrane in the construction of thin bituminous surface-treated roads was started in South Carolina in 1926. In an article, "Cotton-Fabric-Reinforced Roads," published in *Engineering News-Record* Oct. 3, 1936, W. K. Beckham and W. H. Mills of the South Carolina State Highway Department, described eight experimental projects constructed in that state, and concluded that cotton fabric used as a reinforcement in the bituminous surface-treatment appeared to reduce cracking, raveling and failure.

Several experimental projects have been constructed elsewhere, the most widely known one having been on Stultz Lane near Cranbury, N. J., in 1934. It is reported that on this strip the cotton fabric reduced raveling and tended to prevent the road from disintegrating during the winter and spring. (See report "Cotton Roads" by C. T. Revere published by Muns, Winslow and Potter, July 24, 1935).

Although these experiments yielded promising results they were not conclusive in answering questions as to where and under what conditions it might pay to use cotton fabric in the construction of roads. At a time when the cotton surplus and industrial unemployment were placing heavy financial burdens upon the federal government, it appeared obviously worthwhile therefore to investigate thoroughly a field of use which might result in large annual increases in domestic cotton consumption.

It was planned to build thin bituminous surface-treated roads where the volume of traffic is insufficient to warrant the expenditure necessary for constructing concrete pavement. The method is as follows: After the base course has been constructed and placed in proper condition a prime coat of bituminous material is sprayed on the surface and allowed to penetrate. When cotton fabric is used it may be laid down immediately after the bituminous material is applied, or it may be laid after the prime coat has dried. In the latter case, the fabric must be pinned down so that it will not be disturbed by the subsequent construction operations. A second application of bituminous material is then sprayed on top of the fabric and this is covered with crushed aggregate and rolled. By using a rather open weave fabric without sizing, the fabric is thoroughly embedded in asphalt and the fibers are impregnated with asphalt which prevents bacterial action.

Previous experiments had indicated the general type of fabric most suitable for the purpose, but to secure more adequate information as to necessary construction and cost of

TABLE I — NUMBER OF COTTON CONCRETE CURING MATS SUPPLIED TO STATES

State	Number of Mats
Arkansas	1,500
Arizona	920
California	2,000
Georgia	1,000
Illinois	1,870
Indiana	1,500
Michigan	2,400
Minnesota	4,200
Mississippi	2,100
Missouri	4,200
Nevada	1,250
New York	25,400[1]
North Carolina	2,755
Ohio	2,200
Oklahoma	1,500
Oregon	1,000
Pennsylvania	4,500
Rhode Island	6,000
South Carolina	1,200
Texas	20,000
Washington	420
West Virginia	900
Wisconsin	720
Total	89,535

[1] Not all mats of standard size, about 40 per cent being of half-size for special-type work.

TABLE II — QUANTITY OF ROAD FABRIC SUPPLIED TO STATES FOR REINFORCING THIN BITUMINOUS SURFACES

State	Linear Yards	Square Yard	Miles 18 ft. Road
Alabama	553,212	1,260,094	119.33
Arkansas	54,000	123,000	11.65
Arizona	73,287	171,952	16.28
California	26,400	66,000	6.25
Florida	23,760	54,120	5.12
Georgia	63,360	144,320	13.66
Indiana	55,440	114,060	10.80
Maine	10,560	18,187	1.72
Massachusetts	21,120	43,413	4.11
Michigan	179,190	447,975	42.42
Mississippi	48,000	109,333	10.35
Missouri	102,960	257,400	24.37
Montana	15,840	39,600	3.75
Nevada	28,740	66,167	6.26
New Hampshire	10,560	21,707	2.05
New Jersey	45,000	102,500	9.70
New York	528,700	842,122	79.75
North Carolina	517,440	1,115,253	105.61
Oregon	21,000	36,167	3.42
Rhode Island	64,800	125,100	11.84
South Carolina	295,680	669,973	63.44
Tennessee	31,650	72,092	6.83
Virginia	52,800	89,173	8.44
Washington	67,940	177,078	11.08
Total	2,891,439	6,166,786	578.23

Fig. 2. The use of cotton curing mats permits the contractor to seal transverse joints at any time.

fabric three types of fabric were supplied. Type A fabric weighed 5.3 oz. per sq.yd. and had a count of 12 threads per inch in the warp and in the filling and a minimum average breaking strength of 45 lb. in warp and filling. Type B fabric weighed 4.25 oz. per sq.yd. and had 9 threads per inch in warp and in filling and a minimum breaking strength of 35 lb. Type C fabric weighed 3.2 oz. per sq.yd. and had 7 threads per inch in warp and in filling and a breaking strength of 25 lb. each way. The yarn used was two-ply with a balanced twist and of sufficient strength and count to meet the fabric specifications.

Except where necessary to meet special conditions it was provided that the roads be constructed with each of the three types of fabric and also without fabric, in sections of sufficient length to permit keeping separate records of cost of construction and upkeep.

As shown in Table II, 24 states took a total of over 6,000,000 sq.yd. of fabric, or sufficient to construct 578 mi. of road 18 ft. wide. Due to the lateness of the season before the fabric was received by the states only part of it was utilized in the fall of 1936 and the remainder was used in the spring and summer of 1937. It has been used both in the construction of new roads and in resurfacing old roads. In a few instances it has been used in surfacing bridges and in covering the shoulders of roads. (ENR, Nov. 26, 1936).

The same engineering principle that is involved in the use of cotton fabric in road construction also applies in its use in constructing bituminous surfaced airport runways. The use of the fabric was specified for the construction of the runways at Riley Field, Fort McClellan, Ala. and to permit this undertaking to be carried out, 10,000 yd. of 74-in. fabric was recently supplied by the AAA. This fabric was the same as Type B fabric described above. According to latest information (Dec. 27, 1937) work on the soil base is still in progress and the surfacing has not been started. The Bureau of Air Commerce of the Department of Commerce is considering the use of fabric in building airport runways.

Fabrics similar to Types A and B described above, have recently been supplied by the AAA for lining irrigation canals and ditches. The Bureau of Agricultural Engineering was supplied 10,000 lin.yd. for lining an irrigation canal near Grace and Soda Springs, Idaho. The Soil Conservation Service was supplied 4,500 lin. yd. for lining terrace outlet ditches near Santa Paula, Calif., 1,000 yd. for lining ditches near Conway, Ark., and 200 yd. for lining terrace outlet ditches near Albuquerque, New Mex. Details as to the method of construction are available only for the Soda Springs project.

This canal was constructed with a flat bottom and sloping sides. Both the sides and bottom were first covered with a coat of asphaltic material at the rate of ½ gal. per sq.yd. The cotton was next applied with 1 ft. of fabric extending beyond the upper edge of the canal side. The fabric was tacked down with metal strips and pins. The fabric was then covered with two coats of asphaltic material at the rate of ½ gal. per sq.yd. for each coat. Dean Clyde of the school of engineering, University of Utah, in reporting on the construction of the Soda Springs project, stated that it should serve a good purpose in many irrigation canals.

It is too soon to forecast what the experience records for the various projects will show, but preliminary indications suggest that cotton fabric may serve a useful purpose and find an important outlet as a reinforcement membrane for bituminous materials. From the standpoint of utilizing cotton, such outlet is of a very desirable nature since the proper fabrics are coarse and can be made from low-grade cotton at a comparatively low manufacturing cost.

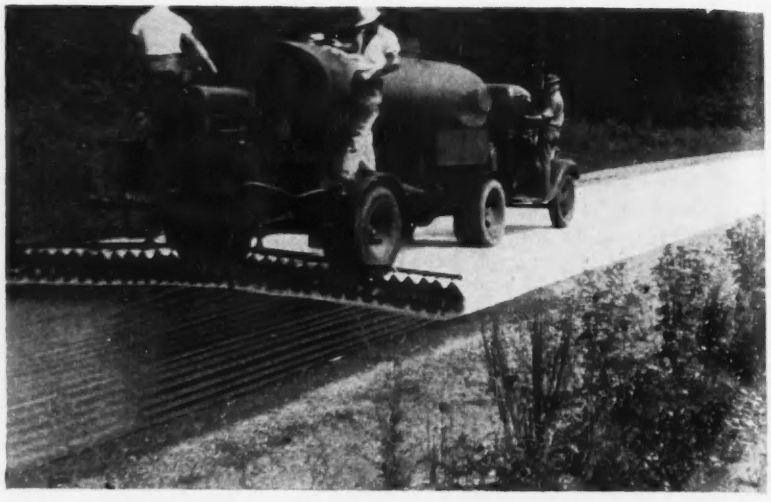


Fig. 4. Reinforcing fabric sealed to the subgrade is sprayed with asphalt and covered with a thin layer of sand on this North Carolina trial road.

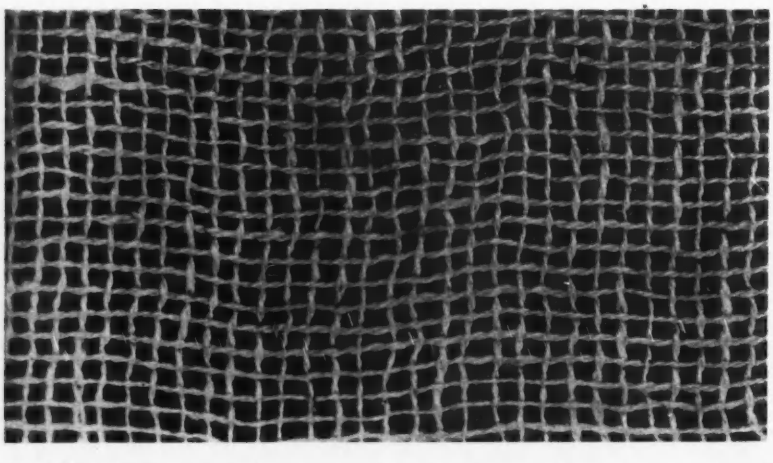


Fig. 3. Cotton fabric reinforcing for thin bituminous surfacing is a coarse-mesh cloth as shown here in about actual scale.

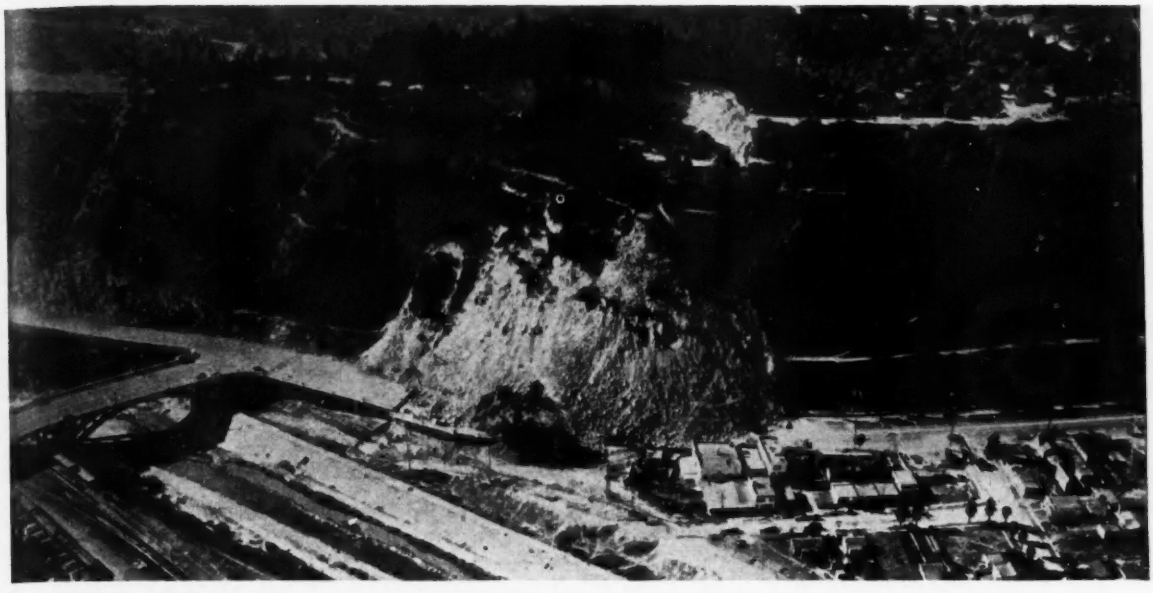


FIG. 1. AIRPLANE VIEW OF ELYSIAN PARK SLIDE SHOWING HOW THE VIADUCT WAS LOADED

Concrete Viaduct Tested to Destruction

by MERRILL BUTLER
Deputy Engineer, Bureau of Engineering, Los Angeles

The Elysian Park slide in Los Angeles gave opportunity to observe the kinds of failure that occur when a well-built structure collapses under enormous overload, side thrust and impact

THE Elysian Park slide in Los Angeles has had much more general publicity than the importance of the incident warranted, but there are some facts of engineering interest in connection with the wrecking of the Riverside Drive concrete viaduct at the toe of the slide that should be useful in studying the nature of the loads and stresses.

Riverside Drive is an important thoroughfare which closely skirts the base of a very steep slope on the east side of Elysian Park. In order to crowd the 67½-ft. roadway in between the slope and the channel of the Los Angeles River the toe of the slope was cut away somewhat at the time the road was built. There is a slight curve in the road at just the point where the slide occurred, and here begins the concrete viaduct which raises the roadway to the level of the connecting thoroughfare farther down the river channel.

In the park at a level 300 ft. above Riverside Drive and at about the same distance back from it (to the west) one of the park roadways skirts the crest of the steep slope. It was on this crest roadway that the first evidence of the slide was noted. Here a small crack was observed in the pavement on Oct. 29; four days later it had widened noticeably and settlement had begun along the line of an old fault.

The widening crack soon isolated about 4.7 acres from the remainder of the hill. At first movement outward and downward was about equal, at the rate of ½ in. per day. In a few days the movement speeded up to 1 in. per day, later to 3 in. and then to 8 in. In the 24 hr. preceding 9 a.m. Nov. 26, the movement was 17½ in. On that date at 10:30 a.m. a major slide occurred that covered the full width of Riverside Drive for a distance of 450 ft. and wrecked the north 145 ft. of the reinforced concrete viaduct. A general view of the disturbed area indicating the nature of the load which brought about the "test to destruction" is shown in Fig. 1.

Features of design

The viaduct is essentially a trestle consisting of a series of continuous slab spans 14 in. thick carried on bents whose spacing varies from 14 ft. 2¼ in. to 15 ft. 5 in. The slab is continuous between transverse expansion joints, which are 57 ft. (at the lower end) to 91 ft. apart. Two sections aggregating about 145 ft. in length and one 15-ft. span of the next adjoining section were destroyed by the slide.

Typical dimensions and reinforcing of the structure are shown in Fig. 3. The design was for a live load of a 21-ton roller per traffic

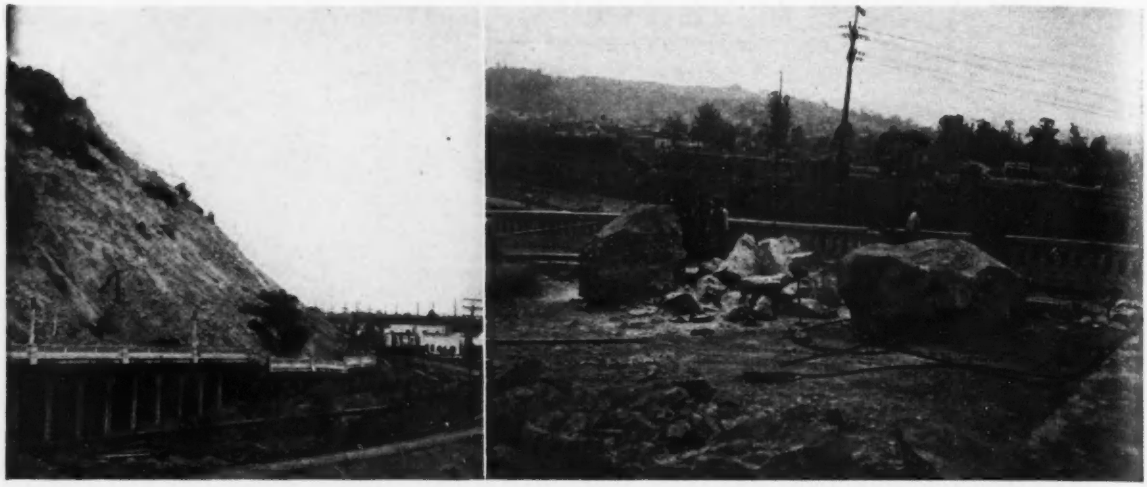


Fig. 2 (a) This view from the adjoining concrete arch bridge shows how side thrust forced one deck slab section out of line. (b) These boulders crashed down on the deck while it was being moved outward by horizontal thrust.

lane with 30 per cent impact allowance followed and preceded by a uniform loading of 200 lb. per sq. ft. Working stresses were 750 and 16,000 lb. per sq. in., with $n = 15$. proportions were 1:2:3, using a carefully graded combination of rock in three sizes (¼, 1 and 1½ in.) and a combination of sand and plaster sand. The batches were mixed 90 seconds. Crushing tests after 28 days gave some values up to 5,350 lb. per sq. in. and an average well above 4,000 lb.: in only three instances was the strength less than 3,500 lb. and the minimum was 2,800 lb. per sq. in. These values indicated that a much higher working stress could have been used. Provision was made in the design for lateral stresses ordinarily to be expected; no attempt was made to design the structure against a major movement of the adjoining hillside.

The column length varied from a minimum of 3 ft. close to the hill to as much as 50 ft. in the outer row along the river face of the structure. However, especially in the sections that were destroyed, from 50 to 75 per cent of the length (which is measured from top of footing to bottom of cross-girder) is below the natural ground surface. This happens because it was necessary to carry the footing down a considerable depth to obtain good foundation on the underlying sandstone.

Effect of overload

The lower sections of the viaduct were entirely covered by the slide to depths varying from 4 to 40 ft. These figures indicate static loads as high as 4,000 lb. per sq. ft. and an indeterminate but heavy lateral pressure against the side of the structure.

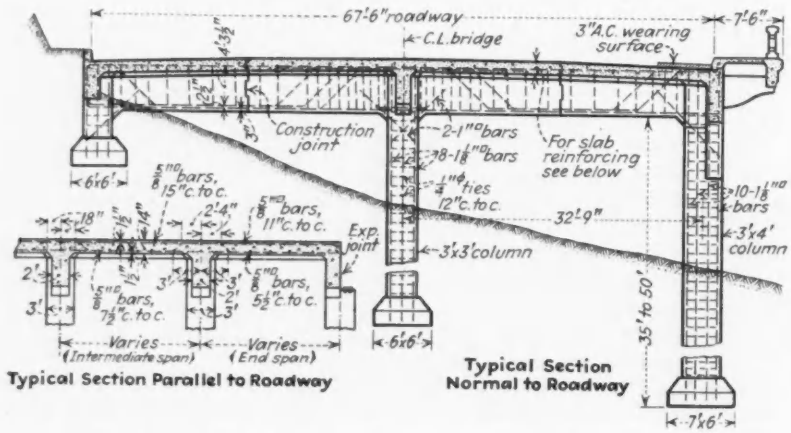


Fig. 3. Sections through the viaduct showing dimensions of members.

The full length of the first continuous deck slab of the structure was buried under the slide. The second section was not completely covered and hence did not have as much restraining vertical load as that carried by the first section. Thus the second section moved horizontally under the outward pressure of the slide farther than did the first section. Also, the deck slab of the second section was subjected to the tremendous impact of the large boulders shown in Fig. 2b, which crashed down the slope onto the deck, doubtless causing heavy concentrated dynamic loading. However, there were no evidences of complete failure in the deck slab resulting from these impacts. In fact, the slab showed surprisingly little evidence of distress due to the heavy loads imposed. Some cracking in different directions occurred.

The immediate cause of failure of the viaduct section that moved outward was the sidewise collapse of the columns along the outer or river side of the structure. These columns failed in bending and in diagonal tension at junction with the cross girder and at or just below the ground surface. This failure permitted the deck to push out and settle. In this process the deck acted as a horizontal beam transmitting the side thrust it received from the slide. However, in this action it suffered no damage that was apparent in visual inspection.

Two interesting points may be noted in connection with the reversed flexure in the columns: one is

Fig. 4. (a) Beneath the structure the effect of horizontal thrust is shown by the tipped columns. (b) A closer view of the second column from the left in the preceding figure.

that they broke off at connection to the deck, where the bending moment was a maximum, and the other is that the passive lateral resistance of the surrounding earth caused the underground breakage to be not far below the surface. In general, the steel bars did not break but the concrete shattered and the steel unraveled from it. The stresses that must have been transmitted through the deck slab, and the fact that the only visible damage was some cracking of the slab, indicate that it had a high factor of safety for carrying highway traffic.

Altogether, the impressive fact about the wreckage of the viaduct is the manner in which the entire structure hung together with no broken reinforcing rods in evidence. Also the various parts of the structure were affected in a way corresponding closely to the stresses induced by the unusual combination of conditions described.

Figs. 4a and 4b show typical column failures and also evidences of spalling and some midspan failures of the cross-girders. The latter are ascribed to excessive bending caused either by the vertical loads or by the moments induced by the side thrust or both.

Because it was considered inadvisable to disturb the toe of the slide for the present, a temporary bypass roadway was built around the slide connecting with Riverside Drive on either side of the disturbed area. To avoid risk of further collapse of the partly broken-down viaduct sections, the columns were drilled and loaded with light charges of dynamite. When fired these charges dropped the deck slab to a satisfactory support. Timber curtains were hung along the outer edge of the structure before the blast to prevent concrete fragments from doing damage.

Reconstruction is under the general direction of Lloyd Aldrich, city engineer of Los Angeles.

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Cities Save Money Using Callable Bonds

THE many American cities now planning their annual budgets or drafting long-term financial programs will look with special interest upon the report of the committee on municipal debt administration of the Municipal Finance Officers' Association, which finds that scores of municipalities and counties during the period 1933–37 made phenomenal interest savings by using their callable bond privilege.

The report entitled "The Call Feature in Municipal Bonds," has just been published by the association which has offices at 850 East 58th St., Chicago. The committee bringing it is composed of seven city officials, one bond man and one statistician, and the report is a thorough study of what use cities may make of callable bonds.

The report observes that time will tell how many other municipalities will take a leaf from the book of big business and install the callable bond in their financial policies. This type of bond is fairly common in private corporate financing. Among cities using the callable bond to a limited extent in one form or another are: New York, Chicago, Los Angeles, Cincinnati, Fort Worth, Detroit, Erie (Pa.), Tallahassee and Dearborn. These cities during depression years were able to make savings by callable bond operations, because at early dates they had reserved in their 4, 5 and 6 per cent bonds the right subsequently to call them and pay off bondholders in cash. The cash was secured by selling new refunding bonds; and the great reduction in their interest burdens was due to old fact that bonds could be sold in a 2 to 3 per cent market.

New York City, for example, in 1935 called $50,000,000 of 4¼ per cent obligations due in 1960 but callable since 1930. $16,000,000 were retired and the remainder refunded at a lower rate of interest with a total net savings to the city of $10,380,685.

The report points out that the current municipal bond market is not a good one in which to issue callables, as interest rates are low. It predicts that when a high level of interest rate again appears—perhaps not until another boom period is well under way the call feature will probably be more commonly inserted in municipal bonds. Possible savings from use of the optional privilege are now rather vivid in the minds of public officials.

Canadian Engineers Meet

Super highways, penstock construction, flood control, steam power generation and internal problems discussed by Engineering Institute of Canada at its 52nd annual meeting held in London, Ont.

SUPERHIGHWAYS, highway lighting, flood control on local rivers, penstock construction and steam power generation costs were the chief technical subjects considered at the 52nd annual meeting of the Engineering Institute of Canada held in London, Ont., Jan. 31-Feb. 2. Discussion of these subjects by the 250 members present was more active than usual for such meetings as was also discussion of the institute's internal problems, chiefly the matter of its present and future relation to the provincial professional associations which in Canada are the legally recognized licensing agencies for engineers.

Internal problems

Consolidation of the activities of the Engineering Institute, which is a voluntary technical organization covering all branches of the profession, with those of the professional associations of the several provinces has been under active and sometimes heated discussions for several years past. The movement toward close association progressed to the point where proposed changes in the by-laws of the institute that would have opened the way for the consolidation of many activities were approved at the annual meeting held last February and were ordered sent to ballot. But the proposed by-law changes failed to receive the required two-thirds vote, as a result, according to proponents of consolidation, of a strategic last-minute move on the part of a few opponents of the proposed changes.

The business meeting this year was called upon to consider new proposals for by-law revisions, the most important of which was a new by-law giving the council of the institute power to negotiate with provincial associations and to enter into formal agreements with them after such agreements have been approved by the institute. It was explained to the meeting that during the past summer a group of members had gone over the proposals of the committee on consolidation and had removed from them all contentious clauses. After discussion, the proposed changes were accepted and ordered sent to ballot.

Although the movement toward consolidation on a national basis has been slowed up somewhat, considerable progress toward closer association has been made in some of the provinces. Vice-president McKiel reported progress already made in Nova Scotia. There, following rejection of the proposals of the committee on consolidation, engineers in Nova Scotia were inclined to go ahead with an organization of their own, using their local association as the nucleus. As a result of many discussions between representatives of the institute and the local association, a draft agreement was worked out which provides for close cooperation between the two bodies. Although this agreement cannot now be approved by the institute before the present proposal to change its by-laws has been adopted, it was reported to the meeting that the Association of Professional Engineers of Nova Scotia has already given its approval, almost unanimously. All members of the association will become corporate members of the institute and the association will collect all fees in Nova Scotia remitting a part to the headquarters of the institute and a part to each of the branches in the province. This arrangement is somewhat similar to that provided for in the by-laws that failed of adoption last summer.

The meeting also was advised that similar arrangements were already being discussed by the local associations in Manitoba, Saskatchewan, and New Brunswick.

Two proposals to change the administrative control of the institute through other changes in the by-laws were the subject of pointed discussion. Their purpose is to broaden the administrative control in order to eliminate what was declared at the meeting to be the almost complete domination of the institute's functioning by a small group in Montreal. This has come about mainly because meetings of the institute's council are generally held in Montreal where, due to the high cost of transportation, few members from other branches attend.

The two proposals also went forward to ballot by the membership.

Safer highways

Highway problems were considered at the first of the technical sessions in two papers, the first by C. A. Robbins, district engineer, Ontario Department of Highways, and the other by Miller McClintock of Harvard University. Mr. Robbins considered "Engineering the Highways for Safety" and Dr. McClintock spoke on "Engineering Efficiency into the Highways." In discussion, several speakers pointed out that either approach inevitably led to the same goal.

Mr. Robbins suggested that whatever engineers might do in connection with safety measures on highways, in the final analysis accidents were mainly due to the incompetence of drivers. This point was echoed by other speakers, and was considered in Dr. McClintock's presentation. The latter suggested that many of the elements leading drivers into accidents could be removed, but

only by the construction of superhighways, called by him, "limited ways." Mr. Robbins pointed out that entire relocation is often necessary if a first class highway is to be obtained, in view of the devious location of many old roads which can not economically be corrected. He cited two examples of such new road construction now being carried out in Ontario, between Burlington and Niagara Falls, and between Gananoque and Brockville, mentioning also that the province has at present about 120 miles of dual-lane highway either completed or under contract. He illustrated his remarks with many views of the newly completed dual highway between Toronto and Hamilton, the first example in Canada of this type of construction on any large scale.

Mr. Robbins also referred to highway lighting, foretelling an extension of this on main highways in the near future; he said that Ontario is at present experimenting on a large scale with both sodium and incandescent types of lighting.

Dr. McClintock's speech consisted mainly of an analysis of road troubles and the development of the "limited way" as the only complete solution to highway problems. Many examples were given of the beneficial results of such superhighway work, and methods utilized in planning such developments were considered as also were the necessary preliminary traffic surveys.

Discussion on the two papers, occupying two sessions, ran the whole gamut of road construction and usage, from comments on the mud splashed up by the rear wheels of trucks not fitted with mudguards as a potent accident cause, to a strong plea for the elimination of all automobile horns. Color of pavements, sidewalk design, special flash signals at schools operated at school hours and uniformity of highway signs were among the many points touched upon by different speakers. Focal points of discussion seemed to be the parking trouble and its solution, the needs of pedestrians, and lighting of roads.

Local flood control

The other important group of papers were concerned with a local flood-control problem. What is known as "Western Ontario" is generally that part of the province bounded by the Georgian Bay, and Lakes Huron and Erie. The southern part of this area is drained by two rivers, the Thames and the Grand. In the spring of 1937 both rivers rose to unprecedented heights and caused much damage before their flood subsided. Four papers were presented dealing with this problem, which affected the city of London keenly. Precipitation in western Ontario was discussed by J. Patterson, controller of the Meteorological Service of Canada, and surface runoff records for the two rivers concerned by N. Marr, chief hydraulic engineer of the Dominion Water Power Bureau, Ottawa; the effect of agricultural drainage on stream discharge in the same area was reviewed by G. A. McCubbin, consulting engineer of Chatham, Ontario: and a survey of flood control and water conservation proposals and possibilities for the region was reported by F. P. Adams, of Brantford, Ontario, who acts as secretary to the Grand River Conservation Commission in addition to city engineering duties. The combined water-shed area is less than 5,000 sq. mi., so that the problem is a small one as compared with similar problems in the United States. It is of great local importance, however, since many small cities are located in the drainage areas practically all of which have been developed for agricultural or urban use.

The papers brought out that deforestation is probably not responsible for the heavy floods, nor agricultural drainage, the main cause being an unusual heavy rainfall following a period of frost. At such times ground surfaces are frozen giving a high runoff. Discussion was confined generally to local aspects of the more general problem. It was indicated that conservation work on the Grand River may be expected to proceed in the not too distant future, following a survey and recommendations by the engineers of the Ontario Hydro Electric Power Commission, but no such progress appears to have been made in connection with the Thames River. Administrative control, and financing of remedial works were mentioned often since, as the problem is relatively a new one for Canada, no general regulations at present exist on these matters.

The two remaining papers were of a more technical nature. The first on Canadian steam-electric power plants was presented by Prof. C. A. Robb, of the University of Alberta, and showed by a comparison of many interesting statistics of British, American and Canadian steam stations that the thermal performance of Canadian steam-electric plants does not compare favorably with that of plants of comparable size in other countries. The advantages of combined steam and water power operation were stressed. The second paper, by A. W. F. McQueen and E. C. Molke, associated with H. G. Acres and Co., consulting engineers of Niagara Falls, Ont., described the design and construction of an 18-ft. diameter steel pipe line, 445 ft. long, built as part of the Outardes Falls Power development, now being completed on the north shore of the Gulf of St. Lawrence to supply power to a newly erected paper mill. Design pressure heads varied from 113 to 177 ft. The pipe is of welded plate construction, supported by welded stiffening ring girders, having been designed following Schorer's methods. Two slip ring expansion joints only are included, on either side of a central anchorage, the pipe being back-filled to the horizontal diameter, and housed over for its upper portion. The upper part of the exterior was given a special protective coating, but no coating of any kind was placed on the interior of the pipe.

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Toledo Water Finances In Good Shape

FROM the year 1929 to the year 1936 the balance in the Toledo water works fund has increased from $650,708 to $1,848,484, or almost 300 per cent. During the same period the bonded indebtedness of the water system has been reduced from $1,682,000 to $608,000, according to an item in the Toledo *City Journal*.

The report points out that while it is true that the bonded indebtedness of the system has been steadily reduced, and at the same time a large cash reserve has been accumulated, much of the plant has become obsolescent. A recent comprehensive engineering survey of the system disclosed that there is dire need of a $9,500,000 improvement program.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

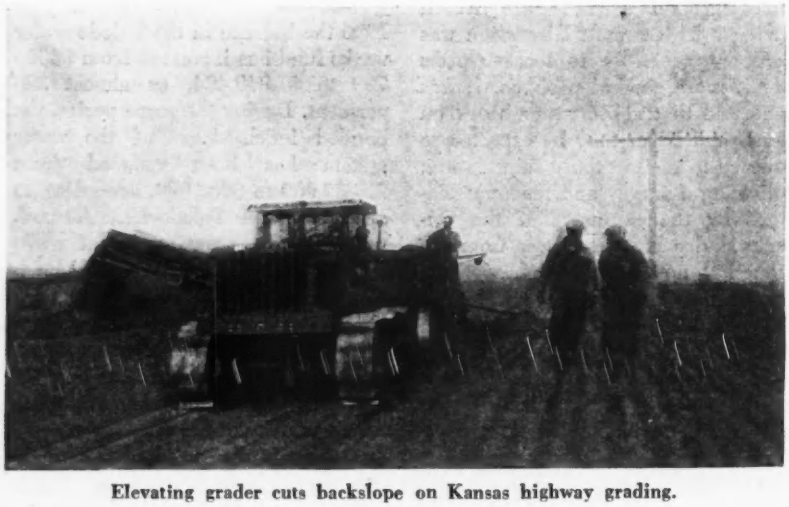
Elevating Grader Cuts Backslopes

by FRED S. CLAUS
Resident Engineer,
Kansas Highway Commission,
LaCrosse, Kan.

Conversion of an elevating grader into a backsloping machine reduced costs in carrying out the recent N.R.S. day labor road project in Kansas. The converted grader was used to move the backslope material across the 12- and 16-ft. ditches to the roadway embankment. An average of about $150 per mile was saved on blade grader manipulation alone. Material for fine grading was cast directly from the backslopes to the roadway surface.

The sloping device was mounted on the machine by removing the plow disk. A heavy chain which slipped into a slotted T-iron extension of the plow beam held the outer end of the cutting blade; a turnbuckle in the chain provided the proper tension. To obtain the slope desired on the blade a telescoping pipe with a pin dropping into matched holes was used. Since the three connections were integral with the plow beam, the device could be controlled the same as the plow. A chain and windlass hoist was built on the elevator and only 3 min. were required for the conversion.

The cutting blade could be varied from a 1 on 1 slope to horizontal. It was used in the horizontal position for cleaning loose material from the ditches. No difficulty was experienced when light rock, stumps or roots were encountered due to the shearing action of the cutting edge. It was found that successful operation depended on the proper adaption of a cutting edge to the moldboard.



Elevating grader cuts backslope on Kansas highway grading.

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Seeking Stable Foundations

In building a highly modernized dual road to replace some 15 mi. of the old Lincoln Highway just east of Gary in northern Indiana the state engineers took the opportunity to experiment with different foundations. The new road is on a clayey subgrade; under one roadway the soil was left as graded but under the parallel roadway seven different types of foundations were constructed each for a length of 2500 ft. The behavior of these special constructions in contrast with parallel natural soil foundations will be recorded as the road passes through the seasons and periods of service. The seven foundations are:

1. A 6-in. sand fill over the natural clay base.

2. The top 3 in. of the clay subgrade was scarified and thoroughly loosened; then 125 lb. per sq. yd. of limestone dust was applied and the limestone and clay were thoroughly mixed in the road.

3. A water-saturated subgrade, prepared by plowing 12 in. deep and thoroughly scarifying and pulverizing, soaking for 72 hr. with water, draining off the surplus water and rolling the base at optimum moisture content. The base was kept wet until ready to roll.

4. A 3-in. layer of pulverized clay on the subgrade was shot with 1½-gal. of T.C. tar per square yard in three applications; the first was a prime coat of ¼ gal., the second and third were equal applications of the remaining 1¼ gal.

5. The same as No. 4, except that A.E.S.I. emulsified asphalt was used instead of tar.

6. The same as No. 4, except that M. C. 1 asphalt was used instead of tar.

7. Pre-stabilized base, made up as follows: Graded limestone and limestone dust were thoroughly mixed dry in a concrete mixer. This material was then put in spreader boxes and spread over the road to a loose depth of 4 in. and then rolled to a compact depth of 3 in. During the rolling process 8 per cent of water was added. In effect, this made a waterbound macadam base, very dense, weighing 150 lb. per cu. ft.

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"Cherry Pickers" on Trucks

Small cranes of 2-ton capacity were a great convenience in speeding the foundation cleanup work done inside the Grand Coulee cofferdam preparatory to pouring concrete. Several of these small motor-driven cranes of the type known as "cherry pickers" were used on the job. Because the east cofferdam enclosed an area of some 50 acres and because so many road changes were necessary to follow the progress of the excavation, the standard running gear of the small cranes was not always able to meet the requirement of rapid transportation within the coffered area. To meet this situation a crane frequently would be placed in the bed of a motor truck whose body had an open road end. Thus the truck could move rapidly to desired parts of the work and the small crane, ordinarily equipped with a 14-ft. boom, had the advantage of height afforded by the higher level of the truck body.

THE WEEK'S EVENTS

Continued from page 253

Housing Projects Leased To Local Bodies

The U. S. Housing Authority has turned over New Towne Court, $2,500,000 housing project in Cambridge, Mass., and Brand Whitlock Homes, a $2,000,000 Toledo project, to local authorities. The federal body has also announced rentals on Highland Homes, a small $344,000 project in Wayne, Pa., which it will have to operate itself because no local authority has been formed.

The lease by which New Towne Court has been turned over to the Cambridge Housing Authority establishes the rentals which may be charged; these will average $4.64 per room per month exclusive of utilities, and the gross rental, including heat, hot water and gas will range from $23 per month for a three-room apartment to $30.80 for a five-room apartment. The lease will run from Feb. 1 to Sept. 30, 1939; the Cambridge Authority will pay no rent the first month but thereafter will pay $835.25 per month or $10,023 per year. In addition the local agency will pay the U. S. Housing Authority $5,000 to be set aside for payment of state and local taxes for 1938. Any surplus derived from operation of the project will be turned back to the United States in the form of added rent.

The Toledo lease sets up an average rental per room of $5.03 per month with an additional $2.11 per room per month for utilities. The schedule provides that a two-room apartment will rent for $19.07 and a five-room for $30.47.

Rentals on the 51-unit project in Wayne will average $4.55 per room per month plus about $2.31 for utilities. Rentals here will range from $17 for a two-room to $30 for a five-room apartment.

Although Pennsylvania law provides for the establishment of local housing authorities, no such body has been set up in Delaware county where the project is situated. The U. S. Housing Authority therefore will operate the project until it can be leased to a local authority.

Policies Described

The policies under which Mr. Strauss plans to operate the U. S. Housing Authority were outlined in a speech which he made at a luncheon of the Architectural League of New York Feb. 3. He said that all buildings would be kept as simple as possible and that projects would be located on low-cost land in the outlying area of cities rather than in the present tenement slum districts where the price of land is high, and that wherever possible projects would be made into more or less independent communities.

He said that the authority would attempt to place some responsibility for the maintenance of projects on tenants and that he was encouraging local authorities to study two- and four-family dwellings because of the lower maintenance cost of this type of housing.

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Local Agencies Asked To Report on Relief

City, county and state executives in the United States have been asked to give full statements of their experience in providing for the unemployed, the National Emergency Council has announced. The request comes from ten organizations interested in community planning, organized under the name of the United States Community Improvement Appraisal. This organization is attempting to gather first-hand information on the success of the various federal emergency employment programs.

The survey is first being undertaken by states, and a sponsoring organization in each state will send a form of questionnaire to state officials and to city and county officials asking them to detail the experiences of their communities. The reports so received will be evaluated by a committee of civic leaders selected by the state agencies, and these state evaluations will then be sent to Washington to be summarized by a national committee selected by representatives of the ten organizations mentioned. The WPA will act as coordinating agency wherever such aid is needed by state sponsors.

The surveys will attempt to determine the success of the federal programs in meeting the unemployment situation and the value to the community of the various projects undertaken under relief works activities.

Local reports are to be submitted to state sponsors not later than March 8, and it is expected that the whole national summary will be available early in April.

OBITUARY

LaVerne R. Craft, superintendent since 1916 for the Foundation Co. of New York City, died there Jan. 25 at the age of 49. Mr. Craft, a graduate in civil engineering from Columbia University, worked two years for the New York City Board of Transportation before entering the employ of the Foundation Co. He worked for that company from 1916 until 1932, superintending foundation work for many large building, including the Irving Trust buildings, the Cities Service Co. building and the Federal Reserve Bank of New York building. After he left the Foundation Co., Mr. Craft was for some time a PWA supervisor in connection with the Lincoln Tunnel. A year and a half ago he went to Japan, where he had done some work while with the Foundation Co., and acted as a consultant to the Shiraichi Foundation Co. on a proposed vehicle tunnel. He returned here last summer.

Charles E. Pearson, an engineer with the department of sewers in Brooklyn, N. Y., connected with that department for 30 years, died there Jan. 22.

Robert H. White, who retired four years ago from the position of superintendent of streets at Lexington, Mass., which he had held for 40 years, died in Lexington Jan. 25 at the age of 81. Since his retirement, Mr. White had been retained as consultant by the town administration.

S. J. Ferguson, commissioner of public works of the City of Raleigh, N. C., died Jan. 17 at the age of 53.

James S. Lewis, 54, for many years president of the Lewis Construction Co. of Baltimore and formerly a building inspector for the city, died there Jan. 24.

Robert S. Major, 72, resident civil engineer at Birmingham for the Louisville & Nashville R.R. from 1901 until his retirement in 1931, died in Birmingham Jan. 5. Mr. Major was a graduate of Kentucky Military Institute.

John H. Plunkett, chief of building inspection for the Massachusetts department of public works until his retirement in 1935, died in Boston Jan. 27 at the age of 70.

Walter C. Belcher, civil engineer and surveyor, died at Holbrook, Mass., Jan. 28, at the age of 83.

John P. Galber, 78, retired building contractor of Seattle, died there Jan. 24.

PERSONAL

LLOYD MCCORMICK, operations supervisor for WPA at New Castle, Pa., has resigned to take over the duties of supervising engineer for a $1,200,000 building program at Slippery Rock Teachers' College in Pennsylvania.

LEONARD A. BERGMAN has been appointed director of the division of water at Buffalo, N. Y. Mr. Bergman formerly served as director of public works and as city engineer at Jamestown, N. Y. Since 1933 he has been an engineer-inspector for PWA, serving in Buffalo for the past year.

JAMES J. HILLERY has been appointed director of the division of streets of Buffalo, N. Y. He was formerly vice-president and general manager of the Thomas J. McDermott Construction Co. and the John F. Kendall Co. and more lately with the PWA, TERA, and WPA.

D. S. MACBRIDE has resigned as a divisional manager of Lone Star Cement Corporation to become vice-president of the Hercules Cement Corporation, Philadelphia. Mr. MacBride will direct Hercules' sales activities from the company's Philadelphia office.

COMMDR. EDWARD C. SEIBERT, Navy Civil Engineer Corps, has been detached from his duties at the Bureau of Yards and Docks at Washington and named officer in charge of construction for the Naval Air Station at Alameda, Cal. He will be engaged on the new air base there.

COLES A. RAYMOND and B. W. Cornelius have formed the engineering firm of Raymond-Cornelius & Co. with offices at Columbus. Mr. Raymond has been active for many years as a consultant in structural engineering in Ohio. Mr. Cornelius is a graduate of the Thomas F. Clarkson College of Technology at Potsdam, N. Y.

FREDERICK W. GARDINER has been made chief engineer of the Interborough Rapid Transit Co. in New York City, succeeding the late George Pegram. Mr. Gardiner has been with the company since 1899 and earlier was a member of the engineering staff of the New York Central R. R. He is a graduate of Stevens Institute of Technology.

DARRELL N. BLAKE has been named county engineer of Council Bluffs, Iowa. He was formerly county engineer of Cass County and was for five years with the Iowa Highway Commission.

A. ELLIOTT KIMBERLY, formerly chief engineer on sanitary projects in Ohio for PWA, has resigned to practice civil engineering with offices in Columbus.

ARTHUR E. FITZGERALD has been named commissioner of public works of Binghamton, N. Y. He has been acting commissioner there since the first of the year.

ROY G. SPIER has been appointed sanitary engineer at Philip for the South Dakota First District Public Health Unit embracing six counties.

RALPH PATTERSON has resigned the position of county engineer of Boone County, Iowa, which he has held for the past 18 years.

PHILIP SAUM, who recently resigned his position as county engineer of Pottawattamie County, Iowa, has been named engineer for Boone County.

HARRY M. HENDON, who for the past two years has been on leave of absence, serving the Birmingham Industrial Water Supply Commission, from his position as sanitary engineer of Jefferson County, Ala., has been named head of the recently enlarged county engineering department. The duties which Mr. Hendon will undertake were recently expanded by the county commissioners when they merged the sanitary, highway, and convict departments, the office of clerk of the convict department, and the Ketona repair shop.

P. E. DUFRESNE has been appointed city engineer of Three Rivers, Que.

W. O. PRICE has been appointed engineer of safety and planning for the Iowa State Highway Commission. Mr. Price, a graduate of Iowa State College, has been a district engineer for the Iowa Highway Commission since 1919. During the past three years he has been on special assignment with the State Conservation Commission in charge of work by CCC camps.

E. G. PLOWMAN, formerly executive assistant to the Denver municipal water commission, has been appointed traffic manager of the Colorado Fuel & Iron Corp. with offices in Denver.

BRIGG SMITH, formerly commissioner and recently maintenance engineer of the Tennessee State Highway Department, has been appointed chief highway engineer.

J. C. MCCALLEN, district maintenance engineer at Jackson, Tenn., for the Tennessee State Highway Department, has been appointed maintenance engineer for the department, succeeding Brigg Smith.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

AMERICAN CONCRETE INSTITUTE, annual convention, Chicago, Feb. 22-24.

AMERICAN TOLL BRIDGE ASSOCIATION, annual convention, Hotel Chamberlin, Old Point Comfort, Va., Feb. 22-24.

BUILDING OFFICIALS CONFERENCE OF AMERICA, annual meeting, Willard Hotel, Washington, March 21-25.

AMERICAN SOCIETY FOR TESTING MATERIALS, regional meeting, March 9, and committee week, Seneca Hotel, Rochester, N. Y., March 7-11.

AMERICAN SOCIETY OF CIVIL ENGINEERS, Spring meeting, Jacksonville, Fla., April 20-23.

AMERICAN SHORE & BEACH PRESERVATION ASSOCIATION, annual meeting, Washington, D. C., April 19, and Jacksonville, Fla., April 21.

AMERICAN WATER WORKS ASSOCIATION, annual convention, Roosevelt Hotel, New Orleans, April 24-28.

REGIONAL AND LOCAL

SOUTHWEST ROAD SHOW AND SCHOOL, annual session, Wichita Exhibition Building, Wichita, Kan., Feb. 22-25.

ARKANSAS ENGINEERS CLUB, annual meeting, Hotel Marion, Little Rock, Feb. 25-26.

NEW YORK STATE ASSOCIATION OF HIGHWAY ENGINEERS, annual convention, Hotel Martin, Utica, March 3-5.

IOWA ENGINEERING SOCIETY, annual meeting, Iowa City, Mar. 9-10.

NEW JERSEY SEWAGE WORKS ASSOCIATION, annual meeting, Stacy Trent Hotel, Trenton, N. J., Mar. 10-11.

CONNECTICUT SOCIETY OF CIVIL ENGINEERS, annual convention, Hartford, March 15-16.

MICHIGAN SEWAGE WORKS OPERATORS ASSOCIATION, annual conference, Lansing, Mar. 31-April 1.

MICHIGAN ENGINEERING SOCIETY, annual meeting, Grand Rapids, April 7-9.

SECTION MEETINGS, American Water Works Association:

New Jersey, New Brunswick, Feb. 15.
New York, Jamestown, Mar. 17-18.
Ky.-Tenn., Louisville, March 21-23.
Canadian, Windsor, Ont., Mar. 23-25.
Illinois, Decatur, April 5-6.
Indiana, West Lafayette, April 7-8.
Pacific Northwest, Spokane, May 19-21.